APPENDIX E
BIOLOGICAL OPINION

United States Department of the Interior
U. S. FISH AND WILDLIFE SERVICE
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IN REPLY REFER TO:
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March 9, 2011

Colonel Alfred A. Pantano, Jr., District Engineer
Department of the Army
Jacksonville District Corps of Engineers
Pensacola Regulatory Office
41 North Jefferson Street, Suite 111
Pensacola, FL 32502
(Attn: Ed Sarfert)

Dear Colonel Pantano:

This document is the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed Tarmac King Road Limestone Mine Project located in Levy County, Florida, and its effects on the threatened eastern indigo snake (*Drymarchon couperi*) per section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Your request for formal consultation was received on 14 January 2010.

This biological opinion is based on information provided in the *Tarmac King Road Limestone Mine Project Biological Assessment* (January 2010); *Wildlife Survey Results, Tarmac King Road Limestone Mine, Levy County, Florida* (Issued 2008, Revised July 2009); U.S. Department of the Army (Corps) 14 January 2010 correspondence; *Eastern Indigo Snake Recovery Plan 1982*; *Eastern Indigo Snake (Drymarchon couperi) 5-Year Review: Summary and Evaluation 2008*; conversations with applicant's environmental consultant Mr. Steve Godley, Mr. Kevin Enge and Paul Moler (Florida Fish and Wildlife Conservation Commission [Commission]), Ms. Linda LaClaire (Service); and other sources of information. A complete administrative record of this consultation is on file at the Service's St. Petersburg Ecological Services Satellite Office.

In the materials submitted to the Service from the Corps, the applicant determined the proposed action may affect the threatened eastern indigo snake (*Drymarchon couperi*); and may affect, but is not likely to adversely affect the, the endangered wood stork (*Mycteria americana*). The effects determination for the wood stork is based on the relatively minor amount of suitable wood stork foraging habitat proposed to be impacted along with the fact the impacts are not located within the core foraging area of any active wood stork rookery.

The Service concurs with the applicant's determinations for these species. Accordingly, the wood stork will not be discussed further in this biological opinion.

Consultation History

On 14 January 2010, the Service received from the Corps a letter requesting formal consultation, a biological assessment, wildlife survey results, and project drawings.

On 22 March 2010, the Service sent an email to the Corps stating sufficient information was not provided to proceed with a biological opinion. The Service suggested consultation to commence after a draft Environmental Impact Statement has been prepared.

On 7 May 2010, the project was reassigned to an alternate Service staff biologist; the previous staff lead retired. Formal consultation was initiated on this date with the Corps.

On 24 August 2010, a draft biological opinion was provided to the Corps and the applicant's environmental consultant.

On 16 September 2010, Steve Godley (Entrix), Kevin Enge (Commission), Fred Antonio (Orianne Center for Indigo Conservation), and Todd Mecklenborg (Service) met in the action area to discuss the draft biological opinion and field review the site.

On 8 October 2010, a second draft biological opinion was provided to the Corps and the applicant's environmental consultant.

On 21 January 2011, a third draft biological opinion was provided to the Corps and the applicant's environmental consultant.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

Tarmac America LLC is proposing to construct a limestone mine on a ±4,750-acre site located one mile west of U.S. 19 and two miles north of S.R. 40 in Levy County, Florida. The project also includes a ±4,526-acre mitigation parcel located immediately west of the mine parcel, for a combined total of ±9,277 acres. The site encompasses all or portions of Sections 2, 3, 6-11, 14-23, 29, and 30 of Township 16 South, Range 16 East; Section 31, Township 15 South, Range 16 East; Sections 1-3, 11-13, and 24 of Township 16 South, Range 15 East; and Sections 25, 26, 27, 34, 35, and 36 of Township 15 South, Range 15 East. The purpose of the proposed action is to provide construction-grade limestone aggregate, including aggregate that meets Florida Department of Transportation specifications, for buildings and infrastructure. The proposed mine is to provide a major, long-term, regional source of aggregate for Tarmac America LLC's and its customers' use in the west-central area of Florida

Mining will be conducted in the Avon Park deposit, which at this location is very close to the surface with only a few feet of overburden. Limestone mining is a multi-phased process. At the beginning of mining a quarry, the vegetation is removed and the overburden is stockpiled or used for perimeter storm berms. The limestone is then drilled and fractured by blasting to a depth of no deeper than 125 feet. The rock is removed by draglines in the wet and temporarily stockpiled to dry in windrows on work pads. A mobile primary crusher reduces the material in size, after which it is placed on an electric conveyor belt system and sent to the plant site for final crushing, sorting, and washing. The finished products are stockpiled at the plant and shipped to market by dump truck. The waste by-product is then returned and stored in previously mined quarries. Approximately 25 acres are proposed to be mined each year over the estimated 100 year life of the mine.

The Tarmac King Road Limestone Mine consists of a ±4,750-acre Mine Parcel and a ±4,526-acre Mitigation Parcel that is contiguous. Under the Applicant's preferred alternative, mining and related infrastructure development will occur on ±3,900 acres of the Mine Parcel (Mine/Disturb Area) with the remainder (±850 acres, No Mine Area) left undisturbed. These undisturbed areas include all intermittent streams on the Mine Parcel with 25' wetland setbacks, and a natural vegetative buffer of variable width around the perimeter of the Mine Parcel.

Approximately 6,699 acres of wetlands occur on the ±9,277-acre overall site, roughly half of which (±3,277 acres) are characterized by hydric pine plantation. A total of ±2,590 acres of wetlands occur on the ±4,750-acre Mine Parcel, ±1,617 of which (62%) are hydric pine plantation. A total of ±2,068 acres of wetlands are proposed to be impacted on the ±4,750-acre Mine Parcel. The impacts will primarily occur in hydric pine plantation areas totaling ±1,464 acres which constitute 71% of the impacts. Additional wetland communities proposed to be impacted include ±191 forested mixed wetland acres, ±135 pine-mesic oak acres, ±116 mixed hardwood wetland acres, ±16 sloughs and intermittent flow-way acres, ±1 cypress acre, ±134 deep water pond acres, and ±11 borrow pit acres.

The applicant proposes to preserve and enhance approximately 4,630 acres of wetland habitats as compensatory mitigation for the 2,068 acres of wetland impacts. Enhancement on the approximately 4,526-acre Mitigation Parcel would occur through elimination of silvicultural practices, allowing the restoration of hydric pine plantations to historic Gulf Hammock hardwood forested wetlands through removal of pine to no more than 5% slash pine (*Pinus elliottii*) and 10% loblolly pine (*Pinus taeda*) stems per acre, and management of exotic or invasive plant species. Within the Mitigation Parcel, non-forested communities such as tidal marshes and forested areas not requiring active rehabilitation would be preserved. To ensure perpetual protection, the applicant will place the entire 4,526-acre Mitigation Parcel (±4,108 acres of wetlands, ±331 acres upland, ±87 acres of roads) under conservation easement. Prior to completion of all mining activity, the applicant will offer to convey fee simple title to the Mitigation Parcel over to the State of Florida. This will occur after the success criteria established by the regulatory agencies has been deemed complete, which is anticipated by construction year 23. The Mitigation Parcel currently is part of the Gulf Hammock Wildlife Management Area managed for hunting by the Commission. The

Commission desires to continue to allow hunting on the Mitigation Parcel under its management. Pursuant to Condition 35 of Florida Department of Environmental Protection (Department) Environmental Resource Permit No. 0244771-002, which authorizes construction of the Tarmac King Road Mine, and the associated draft conservation easement reviewed and approved by the Department, the applicant may allow, and intends to allow, hunting on the Mitigation Parcel to continue indefinitely. The public or private status of the roads is unclear, and it is possible some of the roads would be required to remain for public use. In addition, ±521 acres of wetlands and ±329 acres of uplands within the Mine Parcel would be preserved by conservation easement.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. The affected area was considered to be the approximately 9,277-acre project area plus an additional 8,444 foot buffer (1.6 miles; 31,061 acres) around the entire project creating a 40,338-acre action area for reasons that will be explained and discussed in the "Effects of the Action" section of this consultation. An action area of this size is sufficient to capture the indirect and cumulative effects resulting from the proposed mining activities.

STATUS OF SPECIES/CRITICAL HABITAT

This section summarizes the eastern indigo snake biology and ecology as well as information regarding the status and trends of eastern indigo snakes throughout its entire range. We use this information to assess whether a Federal action is likely to jeopardize the continued existence of the above mentioned species.

The most recent review of this species can be found in the *Eastern Indigo Snake (Drymarchon couperi) 5-Year Review: Summary and Evaluation* (Service 2008). This review builds on information found in the *Eastern Indigo Snake Recovery Plan* (Service 1982) and the *Multi-Species Recovery Plan* (Service 1999). These documents are incorporated by reference and can be used to obtain more detailed information about this species.

Species/critical habitat description

The eastern indigo snake is among the largest non-venomous snake in North America, obtaining lengths of up to 2.6 m (8.5 ft; Moler 1992). Its color is uniformly lustrous-black, dorsally and ventrally, except for a red or cream-colored suffusion of the chin, throat, and sometimes the cheeks. The scales are large and smooth (the central 3 to 5 scale rows are lightly keeled in adult males) in 17 scale rows at mid-body. The anal plate is undivided. In the Florida Keys, adult eastern indigo snakes seem to have less red on their faces or throats compared to most mainland specimens (Lazell 1989). Several researchers have informally suggested that the Lower Keys eastern indigo snakes may differ from mainland snakes in ways other than color.

Critical habitat has not been designated for this species.

Life history

Most information on the reproductive cycle of eastern indigo snakes is from data collected in north Florida. In this geographical area, breeding occurs between November and April, and females deposit 4 to 12 eggs during May or June (Moler 1992). Speake et al. (1987) reported an average clutch size of 9.4 for 20 captive bred females. Throughout the entire range eggs are laid from late May through August, and young hatch in approximately 3 months. Peak hatching activity occurs between August and September, and yearling activity peaks in April and May (Groves 1960, Smith 1987). Limited information on the reproductive cycle in south-central Florida suggests that the breeding and egg laying season may be extended. In this region, breeding extends from June to January, laying occurs from April to July, and hatching occurs during mid-summer to early fall (Layne and Steiner 1996).

Female eastern indigo snakes can store sperm and delay fertilization of eggs. There is a single record of a captive snake laying five eggs (at least one of which was fertile) after being isolated for more than four years (Carson 1945). It has long been assumed that this event resulted from sperm storage. However, there have been several recent reports of parthenogenetic reproduction by virginal snakes. Hence, sperm storage may not have been involved in Carson's (1945) example (P. Moler, GFC, personal communication 1998). There is no information on how long eastern indigo snakes live in the wild; in captivity, the longest an eastern indigo snake lived was 25 years, 11 months (Shaw 1959).

Eastern indigo snakes spend a great deal of time foraging and searching for mates. The species is diurnal throughout its range (Service 2008). They are one of the few snake species that are active during the day and rest at night. The eastern indigo snake is a generalized predator and will eat any vertebrate small enough to be overpowered. They swallow their prey alive. Food items include fish, frogs, toads, snakes (venomous, as well as non-venomous), lizards, turtles, turtle eggs, small alligators, birds, and small mammals (Keegan 1944; Babis 1949; Kochman 1978; Steiner et al. 1983; Stevenson et al. 2010).

Population dynamics

Few detailed studies of population dynamics of eastern indigo snakes have been conducted, primarily because the species is secretive and difficult to study. Although the sex ratio at birth and in juveniles is not different from 1:1 (Moulis 1976, Steiner et al. 1983), adult sex ratios in the wild are strongly biased in favor of males (Layne and Steiner 1996, Stevenson et al. 2009). Stevenson et al. (2009) attributed this bias to lower rates of survival in females, even though males have larger home range sizes and greater daily movement distances than females (Hyslop 2007).

Adult males are also significantly longer and heavier than females, which is attributed to

male-male combat in this species (Shine 1994, Stevenson et al. 2009). Although both sexes mature at about the same total length (150 cm), males continue to grow after sexual maturity, whereas females apparently devote most available energy to vitellogenesis (Service 2008, Stevenson et al. 2009). Maturity is reached in 3 - 4 years (Service 2008).

Radiotelemetry and mark-recapture have been used to estimate home range size (convex polygon method), daily and seasonal movement patterns, habitat use and the extent of habitat required to support population of this species. In central Florida Layne and Steiner (1996) estimated the mean home range size of 12 males to be 74.3 ha (183.6 ac) and 7 females to be 18.6 ha (46.0 ac). Males also moved significantly more often between successive locations and moved greater distances. In the Gulf Hammock region of Florida, Moler (1985) reported mean home ranges of 48.2 ha - 533.0 ha (119.1 ac - 1,317.0 ac) for four males and 50.8 ha (125.5 ac) for one female. A single male occupied a home range of 185 ha (457.1 ac) in north-central Florida (Dodd and Barichivich 2007). In southern Georgia the mean home range of 19 males (520.0 ha; 1,285.0 ac) was significantly larger than 13 females (103.4 ha; 255.5 ac), and males move more frequently and greater distances (Hyslop 2007).

Using a combination of radiotelemetry and population models, Breininger et al. (2004) investigated the effects of habitat fragmentation on the viability of eastern indigo snake populations in east-central Florida. In this study males had an average home range size of 120 ha [296.5 ac] (females = 41 ha [101.3 ac]; Hyslop 2007), snakes living along primary roads soon died, and edge/area effects were more important than area alone in determining population survival. Layne and Steiner (1996), Enge and Wood (2002), and Hyslop (2007) also found roads to be an important source of mortality in eastern indigo snakes. Moler (1992) suggested that at least 1,000 ha (2,470 ac) of contiguous habitat was required to sustain eastern indigo snakes.

Status and distribution

The eastern indigo snake was listed as threatened on January 31, 1978 (43 FR 4028), due to population declines caused by habitat loss, over-collecting for the domestic and international pet trade, and mortality caused by rattlesnake collectors who gas gopher tortoise (*Gopherus polyphemus)* burrows to collect snakes. At the time of the listing, the eastern indigo snake was considered a subspecies *Drymarchon corais couperi*. Currently, the eastern indigo snake is accepted by the scientific community as a separate species *Drymarchon couperi* (Crother 2000). In 1991, Collins elevated this lineage to specific status based on allopatry and diagnosibility. Subsequent work has supported this designation (Wuster *et. al.* 2000).

The indigo snake ranges from the southeastern United States to northern Argentina (Conant and Collins 1998). Two species occur in the United States: the eastern indigo and the Texas indigo (*D. corais*). In the United States, the eastern indigo snake historically occurred throughout Florida and in the coastal plain of Georgia and has been recorded in Alabama and Mississippi (Diemer and Speake 1983; Moler 1985b). It may have occurred in southern

South Carolina, but its occurrence there cannot be confirmed. Georgia and Florida currently support the remaining endemic populations of the eastern indigo snake (Lawler 1977). The eastern indigo snake occurs throughout most of Florida and is absent only from the Dry Tortugas and Marquesas Keys, and regions of north Florida where cold temperatures and deeper clay soils exist (Cox and Kautz 2000).

Eastern indigo snakes use a mosaic of habitats. Within its current known range of Florida and southern Georgia, the eastern indigo snake occupies a wide range of habitat types including pine flatwoods, scrubby flatwoods, scrub and sandhill, hammocks, wetlands, coastal dunes, and human-altered habitats (Service 2008). Below-ground refugia include the burrows of gopher tortoises, nine-banded armadillos (*Dasypus novemcinctus*), rodents, and land crabs (*Cardisoma guanhumi*), as well as hollow logs, stump holes, and other crevices (Hyslop 2007, Hyslop et al. 2009). Seasonal shifts in habitat use have been widely reported, with eastern indigo snakes typically spending the winter in tortoise burrows in xeric uplands and foraging more frequently in wetlands during the warmer months (Layne and Steiner 1996, Hyslop 2007, Hyslop et al. 2009, Stevenson et al. 2009). In the milder climates of central and southern Florida, eastern indigo snakes exist in a more stable thermal environment, where availability of thermal refugia may not be as critical to snake survival. In the Gulf Hammock Wildlife Management Area, hollow root channels and rodent burrows in the base of live oak trees were the most common den sites, and the edges of wetlands were favorite foraging locations (Moler 1985).

Climate Change

Climate change is evident from observations of increases in average global air and ocean temperatures, widespread melting of snow and ice, and rising sea level, according to the Intergovernmental Panel on Climate Change Report (IPCC 2007). The IPCC Report describes changes in natural ecosystems with potential wide-spread effects on many organisms, including marine mammals and migratory birds. The potential for rapid climate change poses a significant challenge for fish and wildlife conservation. Species' abundance and distribution are dynamic, relative to a variety of factors, including climate. As climate changes, the abundance and distribution of fish and wildlife will also change. Highly specialized or endemic species are likely to be most susceptible to the stresses of changing climate. Based on these findings and other similar studies, the Department of the Interior requires agencies under its direction to consider potential climate change effects as part of their long-range planning activities (Service 2007).

Temperatures are predicted to rise from 2° C to 5° C (3.6° F - 9.0 ° F) for North America by the end of this century (IPCC 2007a, b). Other processes to be affected by this projected warming include rainfall (amount, seasonal timing and distribution), storms (frequency and intensity), and sea level rise.

Climatic changes in Florida could amplify current land management challenges involving habitat fragmentation, urbanization, invasive species, disease, parasites, and water management. Global warming will be a particular challenge for endangered, threatened,

and other "at risk" species. It is difficult to estimate, with any degree of precision, which species will be affected by climate change or exactly how they will be affected. The Service will use Strategic Habitat Conservation planning, an adaptive science-driven process that begins with explicit trust resource population objectives, as the framework for adjusting our management strategies in response to climate change (Service 2006). As the level of information increases concerning the effects of global climate change on the eastern indigo snake the Service will have a better basis to address the nature and magnitude of this potential threat and will more effectively evaluate these effects to the range-wide status of the eastern indigo snake.

Analysis of the species/critical habitat likely to be affected

The proposed action has the potential to adversely affect eastern indigo snake adults, juveniles, nests, and hatchlings within and around the proposed project area. Potential effects include injury, mortality, habitat loss or degradation, and disturbance resulting from construction, operation, maintenance, and management of the proposed limestone mine project.

Critical habitat has not been designated; therefore, the proposed action will not result in the destruction or adverse modification of critical habitat.

ENVIRONMENTAL BASELINE

This section summarizes information on status and trends of the species specifically within the action area. These summaries provide the foundation for our assessment of the effects of the proposed action, as presented in the "Effects of the Action" section.

The environmental baseline includes the past and present impacts of all Federal, State, private actions, and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impacts of State or private actions, which are contemporaneous with the consultation in progress.

Status of the species within the action area

Little is known about the eastern indigo snake in the action area or in the immediate vicinity, other than the information published by Moler (1985). The Florida Natural Areas Inventory has seven locality records in the vicinity of the project, which includes the five snakes radio-tracked by Moler (1985). The species also was reported from an undetermined site on the Waccasassa Bay State Preserve (Kevin Enge, pers. comm.). Only three eastern indigo snakes were observed in roughly 15,000 hours of field effort over a 5-year period in the action area of the Tarmac King Road Limestone Mine. In the same general area and habitat 25 years earlier, Moler (1985 and 2009, pers. comm.) and several colleagues with much less field effort collected six indigo snakes in about 3 months, suggesting that the local population has declined substantially in the intervening years. The major differences

between these two study periods appear to be an increase in secondary roads, traffic, and human activity (including the intensity of silviculture) over time and a decrease in the amount of intact hydric hammock; the percentage of recent clearcuts were about the same (Moler 2009, pers. comm.). By comparison, on protected habitat with limited and controlled access, Stevenson et al. (2008) captured an average of one indigo snake per five person-hours during their mid-November through 31 March survey periods in Georgia, and Layne and Steiner (1996) marked and released an average of 12.4 eastern indigo snakes per year during an intensive effort from 1980 - 1987 at Archbold Biological Station (ABS).

No reliable estimate of the population density of eastern indigo snakes in the action area exists. A 26-year study conducted by Layne and Steiner (1996) at ABS estimated a population density of 2.6 indigo snakes (1.9 males, 0.7 females) per 100 ha (247 ac). They also estimated a lower density based on 5 snakes (3 males and 2 females) that occupied 314 ha (775.8 ac) at 1.6 indigo snakes per 100 ha (0.96 males to 0.64 females). Estimates at the Kennedy Space Center (Breininger et al. 2004) were 5.0 adults and subadults per 100 ha. No statistical confidence limits around these means were published. Both of these sites are considered near-optimal habitat for the species with an abundance of gopher tortoise burrows, foraging habitat, and controlled access to limit road mortality. Although visual surveys are notoriously inaccurate at predicting snake densities (Parker and Plummer 1987), it is feasible to compare the ratio of yearly eastern indigo snake sightings within the Tarmac King Road Limestone Mine action area (3 snakes in 5 years of field effort; 0.6 per year) with the mean number of captures at ABS (12.4 per year). Multiplying this ratio (0.048) by the density estimates at ABS (1.6 to 2.6 per 100 ha) yields an estimated density of 0.08 to 0.13 per 100 ha within the action area, or about 2.9 to 4.7 eastern indigo snakes within the project area and 25.1 to 40.7 individuals in the action area.

Factors affecting species environment within the action area

The 5 eastern indigo snakes tracked by Moler (1985) primarily denned at the base of live oak trees (34 of 58 den sites; 58.6%); although limestone solution holes (17.2%), hollow logs (13.8%) and armadillo burrows (10.4%) also were used. Gopher tortoises are rare in the Gulf Hammock, and accordingly, their burrows are not important refugia at this site. It is likely that eastern indigo snakes in the action area experience higher than normal mortality as a result of road mortality, intentional killing, and forestry operations. An overlay of the existing road network in the action area on a 120-ha home range grid (Breininger et al. 2004) suggests that at this home range size, all adult male eastern indigo snakes would cross an existing road and be subject to road mortality. If the average home range size of male eastern indigo snakes in Gulf Hammocks approaches that of those in Georgia (520 ha; Hyslop 2007), then the home range of all adult males would be intersected by multiple roads. Breininger et al. (2004) estimated that adult annual survivorship of eastern indigo snakes decreased from 0.88 to 0.67 in females and from 0.80 to 0.53 in males if a primary road intersected a 120-ha home range grid.

The effect of road mortality and intentional killing of eastern indigo snakes in the action area cannot be estimated accurately, but is assumed to be potentially significant. Enge and

Wood (2002) found that on rural roads (including unpaved limestone roads) in Hernando County, Florida, with less than 1,000 vehicles per day, annual snake mortality rates and traffic volume were not correlated. Furthermore, paired drift fence/funnel trap surveys showed eastern indigo snakes were proportionately trapped three times more frequently in intact habitats on public lands than at this rural site, suggesting that road mortality had already reduced the eastern indigo snake population at the rural site (Enge and Wood 2002). Deliberate killing of snakes on roads is known to be a common activity throughout the world (Andrews et al. 2006).

No primary (paved) roads currently exist in the action area and most of the year the limestone roads have relatively little traffic; however, during peak hunting season the roads can become well traveled at relatively high speeds. Traffic levels tend to fluctuate throughout the year as timber trucking, hunting, and local residential use changes. However, anecdotal evidence and observed road mortality indicates that local drivers go out of their way to run over snakes on the road. Road mortality in many other snake species was commonly observed during site reviews. Some snakes also were found shot by guns in the action area. In the 24,465-acre Gulf Hammock Wildlife Management Area, 450 recreational hunting permits are issued annually each year (Florida Fish and Wildlife Conservation Commission records) that allows vehicular and off-road vehicle use. The main hunting season coincides with the breeding season of eastern indigo snakes, increasing the likelihood of road mortality as males search for mates. Furthermore, within 1.6 miles of the boundary of the Tarmac King Road Limestone Mine, there are approximately 300 privately-owned lots, many with hunting cabins or homes that are used year-round. Logging trucks are common and site access by the public is generally unrestricted.

Intensive silvicultural activities have been identified as a threat to the eastern indigo snake (Service 2008). Each cycle of clear-cutting and mechanized site preparation during timber harvest may result in direct mortality to adults, juveniles and eggs. Most of the action area has been harvested two or three times since the initial clearing of Gulf Hammock in the early 1970s. Also, the removal of stumps and hollow logs reduce the number and availability of shelter sites (Service 2008). In the Gulf Hammock, Moler (1985) found that hollow root channels and rodent burrows at the bases of live oak trees were the most important refugia for eastern indigo snakes. However, since these trees typically are poisoned to make room for more commercially valuable pine trees in the action area, this resource eventually may be lost (Moler 1985).

Silvicultural activities may also strongly affect the prey base, thermal regime, and habitat selection of eastern indigo snakes at this site. Moler (1985) suggested that in the Gulf Hammock, wetland edges were used frequently as foraging sites and that most eastern indigo snakes avoided uncut hammocks with relatively little groundcover. He found that eastern indigo snakes preferentially used recent clearcuts, suggesting that these sites likely supported a higher diversity of prey and more basking opportunities (P. Moler, pers. comm.). In southern Georgia, Hyslop (2007) also found that within their activity season, eastern indigo snakes also preferred wetlands where 65% of the total foraging events and behavior were recorded. She also noted that eastern indigo snakes avoided dense planted

pine monocultures and favored recent clearcuts where gopher tortoise burrows were common.

Climate Change

Based on the present level of available information concerning the effects of global climate change on the status of the eastern indigo snake, the Service acknowledges the potential for changes to occur in the action area, but presently has no basis to evaluate if or how these changes are affecting the eastern indigo snake. Nor does our present knowledge allow the Service to project what the future effects from global climate change may be or the magnitude of these potential effects.

EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action on the eastern indigo snake, the supporting habitat, and its interrelated and interdependent activities.

The eastern indigo snake has the largest known home range of any North American snake (Hyslop 2007) and the home range of some individuals likely extends beyond the boundary of the proposed project. Home range size in snake species often varies with sex, season, habitat type and quality, the number of radiolocations and duration of the study, and the method(s) used to calculate home range size (Macartney et al. 1988). In all radiotelemetry studies of the eastern indigo snake conducted to date, males have larger home ranges than females (Moler 1985, Layne and Steiner 1996, Breininger et al. 2004, Dodd and Barichivich 2007, Hyslop 2007). Hyslop (2007) reported annual home ranges for eastern indigo snakes in Georgia ranged from 35 - 354 ha (86.5 - 874.7 ac) for females and from 140 - 1,530 ha (345.9 - 3,780.6 ac) for males. To be conservative, the mean home range size of adult males using minimum convex polygon estimates averaged over the two-year field study (520 ha; 1,285 ac) of Hyslop (2007) was used. This mean home range estimate is the largest reported in the literature for this species. Thus, the action area of the proposed project for the eastern indigo snake includes the approximate 9,277-acre project area and an 8,444 foot (1.6 miles) buffer totaling 40,388 acres to consider potential effects to eastern indigo snakes that may have a home range that overlaps the project boundary. The action area incorporates the public portion of King Road from the east project boundary to U.S. 19, which will be used by vehicles to enter and exit the site.

Factors to be considered

Factors considered in the analyses for effects of the action include the distribution of the geographic areas where disturbance will occur relative to the potential value of that area to eastern indigo snakes; the type of disturbance; the proximity of the action to natural areas outside of the project site, but within the action area that may support eastern indigo snakes; the timing of project activities relative to sensitive periods in the snake's life cycle; the duration of potential effects on eastern indigo snakes and their habitat; and the construction,

operation, and maintenance of the project.

Eastern indigo snakes are expected to be present in low numbers in the action area. Initial site clearing and construction activities will affect less than 250 acres per year. When mining commences, about 25 acres will be cleared annually over the 100 year life of mine. Due to the mining methodology, there will be a couple of times over the mine life when more than 25 acres will need to be cleared. At these times it could be up to 250 acres to provide working pads and stock pile areas, as well as to prepare future mine phases. At a clearing rate of 250 acres per year, all proposed impacts could occur within the first 25 years; however, there is no intent by the applicant to clear more area than would be required to maintain an operational mine. Under the currently proposed mine schedule, less than 500 acres would be cleared during years one thru five, and approximately 25 acres would be cleared each year thereafter (except as noted above). At the planned clearing rate, all impacts would occur by operation year 90.

Besides potentially lost cover, habitat, and associated prey, disturbance may occur in the form of pedestrian, equipment, and vehicular traffic, as well as vibration from blasting. Construction noise and vibration could disturb snakes where it exceeds ambient conditions. Visual disturbance from personnel during construction could also affect snakes; however, this potential disturbance may lessen when these altered areas are reclaimed and post-construction vegetation conditions provide more or improved cover. The timing and duration of clearing and reclamation activities will vary with the activities proposed at specific locations. Although construction personnel will be advised to avoid eastern indigo snakes, the operation of equipment in brushy, grassy, or otherwise vegetated areas may disturb snakes that are not readily visible.

Construction and maintenance activities are most likely to occur during daylight hours, the same time that eastern indigo snakes are active. This would increase risk of injury or mortality of eastern indigo snakes during construction activities.

Analyses for effects of the action

The eastern indigo snake is difficult to detect and quantify for the following reasons: wide-ranging distribution; a patchy distribution within suitable habitat; limited detectability due to use of burrows or holes for shelter; there is likely unoccupied suitable habitat; juveniles have limited detectability due to their affinity for thick vegetation; and the use of cryptic sheltering areas that may be temporarily established during construction (*e.g.*, brush piles, equipment stockpiles, and dirt mounds). The lack of practical methods to survey, in conjunction with wide-ranging activity and use of a variety of habitat types makes it difficult to determine the exact number of eastern indigo snakes that will be incidentally taken.

Beneficial Effects

The applicant has proposed as conservation measures to place the approximately 4,526-acre

Mitigation Parcel under conservation easement and, prior to the completion of all mining activity, to offer to convey fee simple title to the Mitigation Parcel to the State of Florida thus expanding permanent protection of occupied eastern indigo snake habitat on the adjacent Waccasassa Bay State Preserve. In addition, the proposed measures will eliminate the destructive and potentially lethal effects of intensive silvicultural activities on the eastern indigo snake, and restore the Mitigation Parcel to the historic Gulf Hammock landscape. Placing the property under public ownership will greatly limit uncontrolled access relative to the baseline condition, and reduce the likelihood of road mortality in this snake species. However, the details of this transaction (e.g., timing, phasing, long-term management responsibilities, authorized and prohibited activities) will not be known until final permit issuance, and will be conditions of the permit(s).

Direct Effects

Injury and Mortality: The proposed action includes vegetation removal, debris piling and burning, blasting, mining, reclamation, and truck traffic within the mine and to and from U.S. 19. Eastern indigo snakes present at the time of the above noted actions could be adversely affected by the project activities. Snakes in the portion of the mine parcel under construction or on the King Road access route are presumed to be most at risk for injury or mortality.

It is difficult to determine the number of eastern indigo snakes (adults, juveniles, hatchlings, and nests) that would be directly subject to mortality or injury by the project. As noted in the status of the species within the action area, the best available science suggests that as few as 3 to 5 adult eastern indigo snakes may be present in the project area. Assuming an adult sex ratio of 2 males to 1 female (Stevenson et al. 2009) and that females nest each year (Service 2008), then about 1.0 to 1.7 clutches may be deposited on the project site each year from these snakes, but from 8.8 to 17.1 of the adult females in the action area may also nest in the project area.

To estimate the number of juveniles and subadults in the population (< 4 years old), the female portion of the Leslie matrix was used for eastern indigo snakes of Breininger et al. (2004) and iteratively estimated a stable age distribution for their "Least Favorable" and "Best Estimate" calculations for survival and fecundity. The tables also assume that these survival and fecundity estimates are constant over time and independent of population density (Begon et al. 1996). These simplifying assumptions are requirements of the model (Begon et al. 1996), and the former assumption is particularly unrealistic, as the eastern indigo snake population in Gulf Hammock appears to have declined substantially in the last 25 years. The juvenile, subadult, and adult snake estimates range from 3.62 to 10.31 in the project area and from 31.50 to 89.25 in the action area. If these estimates of current eastern indigo snake population densities in the Gulf Hammock are low, it will be necessary to reinitiate consultation in the future. The ranges of potential juvenile, subadult, and adult eastern indigo snakes are quantified in the following tables.

Least Favorable		Project Area 9,277 Acres		Action Area 40,338 Acres	
	Stable Age	2.9 Adults	4.7 Adults	25.1 Adults	40.7 Adults
1 Year Old	9%	0.31	0.50	2.76	4.37
2 Year Old	6%	0.21	0.35	1.87	2.95
3 Year Old	6%	0.20	0.32	1.77	2.80
4+ Year Old	80%	2.90	4.70	25.10	40.70
Total		3.62	5.87	31.50	50.82

Best Estimate		Project Area 9,277 Acres		Action Area 40,338 Acres	
	Stable Age	2.9 Adults	4.7 Adults	25.1 Adults	40.7 Adults
1 Year Old	26%	1.64	2.65	14.18	22.99
2 Year Old	16%	1.02	1.65	8.84	14.33
3 Year Old	13%	0.80	1.30	6.92	11.23
4+ Year Old	46%	2.90	4.70	25.10	40.70
Total		6.36	10.31	55.04	89.25

Disturbance during construction: The increased human presence on the site during construction along with the operation of construction equipment and vehicles may disturb eastern indigo snakes to the point they leave the project area. This may result in missed foraging and mating opportunities and these individuals may be more vulnerable to predation and intraspecific aggression; however, this is difficult to estimate.

Habitat conversion and conservation: The mine will represent a permanent change to roughly 3,900 acres (42.0%) of the project landscape for eastern indigo snakes. Approximately 1,114 acres of mine pits are proposed to be completely backfilled with mine tailings and revegetated. These areas are immediately adjacent to the approximately 850 acres of No Mine Areas and will provide travel corridors and habitat for eastern indigo snakes on the Mine Parcel once construction and reclamation are completed. However, the temporal lag in habitats actively being cleared and not yet reclaimed will negatively affect eastern indigo snake breeding, feeding, and sheltering in areas lacking vegetative cover, prey, and structure.

Indirect Effects

The indirect impacts evaluated for the project include: post-construction traffic by vehicles accessing the area for project monitoring, operations, maintenance; and post-construction maintenance of roads, stormwater ponds and reclaimed quarries (including vegetation management methods such as mowing, herbicide applications, and physical removal).

Once construction is completed, vehicular traffic will continue to access the area because of project monitoring, operations, and maintenance. Eastern indigo snakes may occupy the Mine Area during operation and maintenance for the life of the project. These snakes may be subject to injury, mortality or harassment from the operation of vehicles and equipment,

including mowing and minor herbicide application.

Interrelated and Interdependent Actions

Interrelated or interdependent actions are not expected to result from the proposed action.

Species response to a proposed action

Construction, operation, and maintenance of the project can result in actions that may kill or injure individual eastern indigo snakes, destroy nests, and destroy or degrade habitats. Clearing, burning, blasting, earthmoving, construction, operation, and maintenance activities may also disturb eastern indigo snakes by causing them to leave the area, and possibly miss foraging and mating opportunities. Individual eastern indigo snakes fleeing the area may be more vulnerable to predation and intraspecific aggression.

Utilizing the most current scientific and commercial information available, the Service anticipates that approximately 3,900 acres of potential eastern indigo snake habitat within the construction site would be affected by the proposed action. The number of individuals present at the time of the action is not known. The Service estimates as many as 10 eastern indigo snakes may be present within the project area.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

There are about 300 privately-owned lots in the 1.6 mile buffer zone surrounding the project with the remainder being owned either by Plum Creek or the State of Florida. Conversion of the surrounding lands currently supporting eastern indigo snakes to more intensive residential uses that would support fewer eastern indigo snakes could be the most likely cumulative effect. The primary threat today to the eastern indigo snake is habitat loss and fragmentation due to development (Lawler 1977; Moler 1985a). Besides loss of habitat, residential developments also increase the risk of harm to eastern indigo snakes in the interface areas between suburban and native habitats because it increases the likelihood of snakes being killed by property owners and domestic pets. Increased traffic associated with development may also lead to increased eastern indigo snake mortality.

It is difficult to predict the spatial extent or timing of eastern indigo snake habitat loss due to land use conversion within the action area, but outside of the project site. There are roughly 40,341 acres of potential eastern indigo snake habitat excluding the approximately 9,277-acre project area. Of this acreage, approximately 8,666 acres are within the Waccasassa Bay State Preserve and presumed secure from cumulative effects, roughly 22,196 acres are owned by Plum Creek, and about 9,479 acres are in private ownership. The relatively

remote location of the project, absence of paved access roads, and past history of Plum Creek suggest that sale of their holdings in the immediate vicinity of the project for residential development is unlikely. The extent of isolated, non-jurisdictional wetlands on the approximately 9,479 acres of private in holdings is unknown. Assuming that the percentage of uplands (45.5%) and of wetlands (54.5%) on the Mine Parcel is similar on these in holdings, then about 5,166 acres of these private lands consist of wetlands. On the Mine Parcel, the applicant elected to use a Preliminary Jurisdictional Determination for purposes of Corps permitting, which assumes that all waters and wetlands that would be affected in any way by the permitted activity are jurisdictional. The best estimate for the Mine Parcel is less than 5% of the on-site wetlands are isolated and non-jurisdictional. Applying this same estimate to the in holdings indicates that about 258 acres of wetlands may be developed without Federal review and represents future non-Federal actions.

Anticipated future county actions in the action area that will adversely affect eastern indigo snake habitat include the issuance of county building permits. Permits to construct commercial buildings, residential homes, and the associated supporting infrastructure within the action area are required by county governments. Many of the construction projects impacting eastern indigo snake habitat in the action area will require both a county building permit and a Corps permit, which will require consultation under section 7 of the Act.

A small proportion of construction projects requiring county building permits will not impact wetlands and will not require a permit from the Corps. In general, these projects will not have a Federal nexus requiring consultation with the Service under section 7 of the Act. However, applicants obtaining county building permits are not absolved from the prohibition of take of listed species under the Act. Section 10 of the Act provides a means for permitting the incidental take of listed species associated with non-Federal actions such as county building permits. In order to obtain an incidental take permit, the applicant must prepare a Habitat Conservation Plan (HCP), acceptable to the Service, describing how impacts to the species will be minimized and mitigated to the maximum extent practicable. To be acceptable to the Service, an HCP for a non-Federal action affecting eastern indigo snakes would generally include the enhancement, restoration, or preservation of eastern indigo snake habitat.

CONCLUSION

After reviewing the current status of the eastern indigo snake, the environmental baseline of the action area, the effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the project, as proposed, is not likely to jeopardize the continued existence the eastern indigo snake. Limited mortality of eastern indigo snakes and their nests resulting from habitat loss will occur from the construction, operations, and maintenance of the proposed action. However, the loss of this habitat is not expected to appreciably affect the overall survival and recovery of this species. The eastern indigo snake is not anticipated to be extirpated from the action area but will be confined to the suitable habitat remaining in the project area and the surrounding areas. The eastern indigo snake also has some ability to move away from many situations that may result in direct

injury or disturbance and has the ability to access adjacent habitat if escape opportunities are made available. The Mitigation Parcel will expand permanently protected and occupied eastern indigo snake habitat on the adjacent Waccasassa Bay State Preserve. The proposed action will not appreciably reduce the number, distribution, and reproduction of eastern indigo snakes in Florida.

No critical habitat has been designated for the eastern indigo snake; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are nondiscretionary and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to Tarmac America LLC, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require Tarmac America LLC to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the grant, agreement, or permit document, the protection coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Corps or Tarmac America LLC, must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR § 402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service anticipates incidental take of eastern indigo snakes will be difficult to detect and quantify for the following reasons: wide-ranging distribution; a patchy distribution within suitable habitat; limited detectability due to use of burrows or holes for shelter; there is likely unoccupied suitable habitat; juveniles have limited detectability due to their affinity for thick vegetation; and the use of cryptic sheltering areas that may be temporarily established during construction (*e.g.*, brush piles, equipment stockpiles, and dirt mounds).

The lack of practical methods to survey, in conjunction with wide-ranging activity and use of a variety of habitat types makes it difficult to determine the exact number of eastern indigo snakes that will be incidentally taken.

Another difficulty in determining the amount or extent of take for this action is the anticipated duration of this project. The current proposed schedule for mining is 100 years; however, depending on the demand for limestone in future years or yearly operation of the mining activities the action could be complete within 40 years. Additionally, many of the areas mined will be restored to conditions that are anticipated to be suitable for eastern indigo snake occupancy. Recruitment of eastern indigo snakes on the reclaimed areas may occur from occupied areas within the project area or from the surrounding action area throughout the life of the project. Nevertheless, the Service used the best available science and most recent observations to quantify the number of eastern indigo snakes potentially present in the project area and in the action area.

The Service anticipates that incidental take may occur throughout the entire project area (9,277 acres) in the form of harm or harass during project construction activities and reclamation. Incidental take related to the project may occur in the action area, particularly from truck traffic on King Road from the project area east to U. S. 19. Based on the reported densities of eastern indigo snakes at ABS and modeling efforts for this species, from 3.62 to 10.31 eastern indigo snakes may be present on the 9,277-acre project area and from 31.50 to 89.25 snakes in the action area. Assuming an adult sex ratio of 2 males to 1 female, that females 3 years or older nest each year, a stable age distribution, and that some portion of the home range of adult female eastern indigo snakes in the action area may encompass a part of the project area, then the productivity from 1.0 to 17.1 eastern indigo snake nests may occur in the project area.

Based on best available science the Service is authorizing take of no more than 3 eastern indigo snakes over a rolling 5-year period and the productivity associated with no more than 2 eastern indigo snake nests over a rolling 5-year period. This represents from 29% - 83% of the snakes estimated in the project area, but only 3.4% - 9.5% of the snakes in the action area that may be subject to take. Similarly, from 1.0 to 1.7 adult female indigos may nest entirely on the project site, but from 8.8 to 17.1 of the adult females in the action area may also nest in the project area.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

RESONABLE AND PRUDENT MEASURES

The Service considers the following reasonable and prudent measures are necessary and minimize impacts of incidental take of eastern indigo snakes.

Tarmac America LLC will preserve and enhance approximately 4,630 acres of wetland habitats as compensatory mitigation for the 2,068 acres of wetland impacts. Enhancement on the approximately 4,526-acre Mitigation Parcel would occur through elimination of silvicultural practices, allowing the restoration of hydric pine plantations to historic Gulf Hammock hardwood forested wetlands through removal of pine to no more than 5% slash pine (*Pinus elliottii*) and 10% loblolly pine (*Pinus taeda*) stems per acre, and management of exotic or invasive plant species. Within the Mitigation Parcel, non-forested communities such as tidal marshes and forested areas not requiring active rehabilitation would be preserved. To ensure perpetual protection, Tarmac America LLC will place the entire 4,526-acre Mitigation Parcel (±4,108 acres of wetlands, ±331 acres upland, ±86 acres of roads) under conservation and, prior to the completion of all mining activity, offer to convey fee simple title to the Mitigation Parcel to the State of Florida. In addition, ±521 acres of wetlands and ±329 acres of uplands within the Mine Parcel would be preserved by conservation easement.

Although Tarmac America LLC agrees to implement the Service's *Standard Protection Measures for the Eastern Indigo Snake* (revised 2004), a potential for mortality, injury or harassment of eastern indigo snakes from construction and operation activities within the Mine Parcel and Mitigation Parcel still remains. Standard construction conditions require an approved eastern indigo snake protection and educational plan detailing the education of contractors and equipment operators, on-site signs explaining penalties for intentionally killing eastern indigo snakes, instructions that construction activities will cease if eastern indigo snakes are observed, and the required protocol if a dead eastern indigo snake is encountered.

The Service deems the following additional reasonable and prudent measures are necessary and appropriate to further minimize the incidental take of eastern indigo snakes:

1. preconstruction surveys will be performed to note any eastern indigo snake locations;

2. disturbance and injury to eastern indigo snakes shall be minimized during construction activities;

3. disturbance and injury to eastern indigo snakes shall be minimized on roadways;

4. disposition of dead or injured specimens (salvage);

5. monitoring and reporting requirements.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent

measures described above and outline required reporting and monitoring requirements. These terms and conditions are non-discretionary.

1. Tarmac America LLC will complete pre-clearing surveys for each mining unit or sub-parcel to document gopher tortoise burrows or other potential refugias for the presence of eastern indigo snakes. If an eastern indigo snake is found, it will be allowed to move out of harm's way and not handled or relocated along with other commensal species found. If results of the pre-clearing survey indicate greater numbers of eastern indigo snakes present than considered in the biological opinion, thereby increasing potential for incidental take of this species, Tarmac America LLC will inform the Corps and the Service. Additional reasonable and prudent measures may be required at that time to minimize the extent of take of eastern indigo snakes.

2. The Corps will require Tarmac America LLC to provide at least one qualified observer during ground clearing activities. The observer's qualifications will be provided to the Service's Project Biologist (U.S. Fish and Wildlife Service; 600 Fourth Street South; St. Petersburg, Florida 33701; 727-820-3705) 2 weeks prior to initiation of construction or clearing activities. The observer's primary function would be to visually evaluate the area to be cleared immediately prior to, and following vegetation removal, stockpiling, and burning and to record any eastern indigo snake activity. This would also include any other relevant wildlife observations for eastern indigo snake prey or predators. Only permitted individuals are allowed to come in contact with an eastern indigo snake.

3. All roads within the project site (Mine Parcel, Mitigation Parcel, access roads under Tarmac's jurisdiction) will be posted with a 25 mph speed limit.

4. Upon locating a dead or injured eastern indigo snake, initial notification must be made by the applicant to the nearest Service Law Enforcement Office; (U.S. Fish and Wildlife Service; 20501 Independence Boulevard; Groveland, Florida 34736; 352-429-1037). Secondary notification should be made to the U.S. Fish and Wildlife Service (600 Fourth Street South; St. Petersburg, Florida 33701; 727-820-3705), the Florida Fish and Wildlife Conservation Commission (Fish and Wildlife Research Institute; Gainesville Wildlife Research Laboratory; 1105 S.W. Williston Road; Gainesville, Florida 32601; 352-955-2081), and the Jacksonville District Corps of Engineers (Pensacola Regulatory Office; 41 North Jefferson Street, Suite 301; Pensacola, Florida 32502; 850-439-9533). Care must be taken in handling any dead specimens found in the project area to preserve the specimen or its remains in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the Act. If more than 3 dead or injured eastern indigo snakes (harm or harass) are taken as a result of the action over a rolling 5-year period, or the productivity associated with more than 2 eastern indigo snake nests is lost over a rolling 5-year period, reinitiating

consultation will be required to reassess the above reasonable and prudent measures to assure that sufficient avoidance and minimization actions are occurring.

5. The applicant is required to submit an annual report of the status of implementation and operation of the project, including a progress report on the process of reclamation of the mined lands. A report of all eastern indigo snakes observed containing the location (latitude and longitude), dates, times, prevailing environmental conditions, and the circumstances surrounding all sightings. A site map with observation locations shall also be included in this report. If no snakes are encountered, a report shall be submitted indicating that fact. These reports will be sent to the Corps and the Service.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. The Service estimates that no more than 9,277 acres of eastern indigo snake habitat will be incidentally taken or altered as a result of this action, and that mortality, particularly from road mortality in the action area, may occur as a result of this action.

If, during the course of the action, the applicant encounters more than three dead or injured eastern indigo snake snakes or the loss of productivity of more than two eastern indigo snake nests, each calculated over a rolling 5-year period, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modifications of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

- Cooperate with Federal, State, or local research supporting implementation of recovery actions which may include long-term ecological monitoring on eastern indigo snakes densities, prey densities, and habitat conditions in the project area or captive propagation.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law)

and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

The Service appreciates the cooperation of the Corps and applicant's environmental consultant during this consultation. The Service would like to continue working with your agency regarding this project. If you have any questions regarding this biological opinion, please contact Todd Mecklenborg at (727) 820-3705.

Sincerely,

for David L. Hankla
Field Supervisor

cc: FWC, Kevin Enge
Service, Jackson, Mississippi, Linda LaClaire
Service, Jacksonville, Anne Dziergowski

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APPENDIX F
FLORIDA COASTAL ZONE MANAGEMENT PROGRAM FEDERAL CONSISTENCY DETERMINATION

APPENDIX F
FLORIDA COASTAL ZONE MANAGEMENT PROGRAM FEDERAL CONSISTENCY DETERMINATION

The intent of the Federal Coastal Zone Management Act (CZMA) (16 U.S.C. 1456) is to encourage coastal states to manage and balance competing uses of coastal areas that result in impacts on coastal resources. The CZMA gives states the primary role in managing coastal resources provided they develop a federally approved coastal zone management plan (CZMP). Florida has a federally approved CZMP that was approved by the National Oceanic and Atmospheric Administration in 1981 and is codified at Chapter 380, Part II, of the Florida Statutes. The coastal zone is defined as the 35 coastal counties and adjoining waters to the limits of the territorial sea. Levy County in its entirety, and therefore the entire project site and mitigation area, are contained within the designated coastal zone.

The Florida CZMP is based on a network of state agencies and water management districts implementing 24 state statutes that protect the natural, cultural, and economic resources of the coastal zone. Primary oversight is provided by the Florida Department of Environmental Protection. The 24 statutes pertain to a wide range of topics that could be affected by development activities in the coastal zone, including beach and shore preservation; comprehensive regional plans; emergency management; state lands, parks and preserves; transportation; recreation; biological resources; and public health. Evaluation of the substantive issues pertaining to these statutes is addressed in the applicable sections of this environmental impact statement (EIS).

Section 307 of the Federal CZMA contains the Federal consistency requirements. A Federal agency considering actions (including issuance of Federal permits) that may impact the land, water uses, or natural resources of the coastal zone must be consistent, to the maximum extent practicable, with the policies of the state's federally approved coastal management program. In Florida, Federal consistency review is integrated into other review processes conducted by the state through the Florida State Clearinghouse. On November 1, 2010, in accordance with Part IV of Chapter 373 of the Florida Statutes and Title 62 of the *Florida Administrative Code*, the Florida Department of Environmental Protection issued an Environmental Resources Permit (Permit Authorization Number 0244771-002) indicating that the Proposed Action as described in Chapter 2 of this EIS was in compliance with requirements set forth in the Florida Coastal Zone Management Program and thus satisfies CZMA requirements.

APPENDIX G
MITIGATION PLAN

Tarmac King Road Limestone Mine
Compensatory Mitigation Plan
Levy County, Florida

OCTOBER 2011

SUBMITTED TO:

U.S. Army Corps of Engineers

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ENTRIX
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Pursuant to the U.S. Army Corps of Engineers' (the "Corps'") specific request, which it made to CardnoEntrix, Tarmac America LLC's ("Tarmac's") consultant, on May 10, 2011, Tarmac hereby submits this May 2011 update to its *Tarmac King Road Limestone Mine Compensatory Mitigation Plan, Levy County, Florida (March 2010)* (the "Update"). This Update reflects certain Uniform Mitigation Assessment Method ("UMAM") functional assessment scores developed by the Corps. Please note that mere submittal of this update to the Corps, with a copy to SAIC for independent review, does not mean that Tarmac concurs or agrees with these functional assessment scores developed by the Corps, nor may it be construed as acquiescence to same by Tarmac. **TARMAC HEREBY EXPRESSLY RESERVES THE RIGHT TO CHALLENGE THE FUNCTIONAL ASSESSMENT SCORES DEVELOPED BY THE CORPS REFLECTED IN THIS UPDATE.**

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SECTION 1

Introduction

Tarmac America, LLC ("Tarmac") is proposing to mine limestone on approximately 4,750 acres of land in Levy County, Florida (Mine Parcel). The purpose of the Tarmac King Road Limestone Mine is to provide construction-grade limestone aggregate that meets Florida Department of Transportation (FDOT) specifications for buildings and infrastructure. The proposed mine will provide a major, long-term regional source of aggregate for the use of Tarmac and its customers in the west-central area of Florida.

As compensatory mitigation for unavoidable impacts to waters of the United States (Section 404 of Clean Water Act) and to State of Florida wetlands and other surface waters (Basis of Review for ERP applications), Tarmac is proposing to establish two on-site mitigation areas: 1) a ±4,526-acre Tarmac Mitigation Site (TMS) located immediately west of and contiguous to the Mine Parcel, and 2) a ±851-acre No Mine Area within the Mine Parcel.

For purposes of this Compensatory Mitigation Plan, the definitions provided in the joint U.S. Army Corps of Engineers/Environmental Protection Agency *Compensatory Mitigation for Losses of Aquatic Resources; Final Rule* (73 Federal Register 19594) are used.[1]

1.1 LOCATION

The proposed TMS is located north of Inglis between US 19 and he Gulf of Mexico in Sections 6, 7, 11,12,13,17 thru 20 and 29, Township 16 South, Range 16 East; Sections 1, 2 and 31, Township 16 South, Range 15 East; and Sections 25, 26, 35 and 36, Township 15 South, Range 15 East in Levy County, Florida The No Mine Area is contiguous to the Mitigation Parcel and are located within Sections 9, 10, 11, 14, 15, 16, 17, 21, 22, and 23 of Township 16 East, Range 16 East of Levy County, Florida (Figure 1-1).

1.2 ECOLOGICAL BENEFITS

The TMS is designed to provide regional ecological value and greater long-term ecological value than the area of wetlands and other surface waters that will be adversely affected in accordance with the ERP Basis of Review 3.2.1.2(b), F.A.C. The Corps does not have a similar standard, but recognizes the benefits of ecosystem restoration. The major ecological benefits of the TMS are:

1. The property will be placed under a conservation easement to protect and preserve the land in perpetuity (Attachment A). Once all mitigation activities required by the permit(s) for this project have been completed and released, Tarmac proposes to transfer title of the TMS to the State of Florida, Board of Trustees of the Internal Improvement Fund.

[1] Restoration: The manipulation of the physical, chemical or biological characteristics of a site with a goal of returning natural/historic functions to a former or degraded aquatic resource. Rehabilitation: The manipulation of the physical, chemical or biological characteristics of a site with a goal of repairing natural/historic functions to a degraded aquatic resource. Enhancement: The manipulation of the physical, chemical or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s). Preservation: The removal of a threat to, or preventing a decline of, aquatic resources by an action in or near those aquatic resources.

2. The TMS will provide a buffer and functional addition to the Waccasassa Bay Preserve State Park which lies immediately to the west. In fact, the TMS will share about 9.6 miles of border with the Waccasassa Bay Preserve State Park. Unfavorable land management activities outside of the park, specifically timber management and drainage alteration, are cited by the park's management plan (FDEP 2005), as contributing to loss of natural functions in the park's hydric hammocks. The proposed mitigation plan will remove these disturbances in the TMS and provide a buffer from these alterations for the hydric hammocks and other natural communities in the park.

3. The TMS will increase the functional capacity of a broad corridor of existing conservation lands that extends from the Waccasassa Bay Preserve State Park eastward to connect to Goethe State Forest to the east, Cedar Key Scrub State Reserve and the Lower Suwannee National Wildlife Refuge to the north (Figure 1-2).

4. The TMS will provide potential replacement habitat for salt marsh and coastal hydric hammock in the event of continued climate change and sea level rise.

5. The TMS was nominated (but unfunded) for conservation under Florida Forever as part of the 25,655-acre Gulf Hammock Wildlife Management Area (GHWMA). Historically, the hydric hammocks are believed to have supported a greater diversity of wildlife species than most other habitats in north-central Florida (Vince et al. 1989) for a variety of reasons including production of nuts, berries, and dry fruits; presence of large numbers of live cavity trees; proximity to water; and remoteness.

6. The TMS will provide hydrological connections to Waccasassa Bay, the Gulf of Mexico, Spring Run, Demory Creek, Turtle Creek, Smith Creek, and BeeTree Slough.

7. The TMS is part of the Gulf Hammock, the largest area of historic hydric hammock in North America. This hammock was known for plant species diversity and represented the southern range limit for a number of plant species. The limestone substrate at or near the surface supported, and to some extent still support, a flora that has largely been eliminated by land management activities and conversion to agricultural activities and commercial forestry (Vince et al. 1989).

8. Intensive silvicultural activities including mechanical site preparation, planting and tree harvesting on the TMS will be permanently halted. As described below, these activities negatively affect the physical, chemical and biological processes that occur in this ecosystem. Under the current timber management plan, about 93% of the TMS (4,206 acres; exclusive of deep water ponds, fresh water marshes, salt marsh, tidal flats, borrow pits and roads) is under intensive management. Of this total, about 44% is planted in pine and clear-cut on a 25-30 year rotation, and the remaining 56% consists of various hardwoods that are clear-cut on a 40-year rotation.

The current ecological value of the proposed TMS to the regional watershed and landscape is moderate, but can be significantly improved through the mitigation activities proposed in this plan. While the landscape setting and connectivity to other large tracts of undeveloped forested wetlands benefit the ecological value of the site currently, these benefits are largely negated by the intensive silvicultural disturbances that have been ongoing for nearly 50 years. Habitat alteration, especially the conversion of natural, species-diverse stands to pine monocultures and the elimination of live cavity trees, have substantially reduced both species diversity and abundance of wildlife populations (Vince et al. 1989).

Relatively little scientific literature directly addresses the ecological consequences of intensive silviculture on hydric hammocks or in the Gulf Hammock specifically. However, considerable literature, summarized briefly below, does support the notion that the intensive silviculture practices employed at this site strongly degrade the physical, chemical and biological characteristics of the landscape.

Simons et al. (1989) reported that, relative to undisturbed hydric hammock, intensive site preparation for pine planting and harvesting as practiced in the Gulf Hammock: 1) compacted the soils (e.g., infiltration rates of water decreased from 64.8 cm/hr to 6.9 cm/hr in skid trails); 2) channelized sheet flow, accelerated run off, and reduced water retention and filtering capacity of the wetland; 3) increased suspended sediments in receiving waters; and 4) disrupted nutrient cycling by more than two-fold. Likewise, several studies in Florida flatwoods (e.g., Sun et al. 2000, Bliss and Comerford 2002) have shown that clear-cutting significantly increases local water tables and runoff rates, which can persist up to 10 years following the harvest.

Replacing mature mesic or hydric hammock with even-age pine plantations or allowing hardwood forests to regenerate naturally for a later rotational cut also has profound effects on plant community structure and species composition, as well as the wildlife populations it can support. Repeated clear-cutting of hydric hammock often leads to an un-natural dominance of species that sprout from roots or stumps such as sweet gum and persimmon, or seed profusely such as red maple (Simons et al. 1989). Pine plantations are vegetationally and structurally impoverished relative to mature hardwood stands (Simons et al. 1989, Allen et al. 1996, Stapaniam and Cassell 1999). Consequently, the elevated abundance and diversity of foods and foraging strata provided by hardwoods support a greater diversity of wildlife than furnished by pines (Harris and Skoog 1980). Several examples illustrate the potential magnitude of these effects in the southeastern United States:

1. Studies of the Cross Florida Barge Canal (FGFWFC 1976) documented 51 species of amphibians and reptiles in hydric hammocks (57% wetland dependent), but only 23 species in pine plantations (22% wetland dependent).

2. Relative to control flatwoods sites, clear-cutting and site preparation of north Florida flatwoods reduced amphibian abundance ten-fold and lowered reptile species richness significantly (Enge and Marion 1986).

3. The silvicultural practice of converting native longleaf pine savannah to bedded slash pine plantation are believed to be the primary causes of endangerment of the flatwoods salamander (*Ambystoma cingulatum*) in the Southeast (Means et al. 1996).

4. Significantly more bird species winter in mixed hardwood forest than in pine plantations of any age (Kerpez and Stauffer 1989).

5. Relative to bottomland hardwoods and even in mature pine plantations, the density and diversity (H') of breeding song birds in Georgia was 3.4-3.9 and 1.3-1.5 lower, respectively (Johnson and Landers 1982).

6. In Florida, the density of den trees with cavities for nesting average 2,086/40 ha in bottomland forests but only 84/40ha in pine plantations (McComb et al. 1986). In a similar study in Florida, 96% of the variation in cavity nesting bird density and diversity was explained by variation in stand age and snag characteristics (Land et al. 1989).

7. In Apalachicola National Forest, the total density number of bird species increased with the age of slash pine plantations, but even 40-year-old plantations had significantly lower bird densities, biomass and species richness relative to natural longleaf pine forests (Repenning and Labisky 1985).

8. The conversion of upslope mesic hammock to pine plantation reduced mast-producing habitat for a long list of wildlife species, including many of the largest and most important game species such as turkey, squirrel, black bear, white-tailed deer and feral hog (Simons et al. 1989). This implies that the loss of upslope mesic hammock causes a reduction in the carrying capacity of the adjacent hydric hammock for the same species.

The staff of the Florida Fish and Wildlife Conservation Commission (FFWCC) has identified the TMS area as a proposed Strategic Habitat Conservation Area for the Gulf salt marsh mink (*Mustela vison lutensis*), bald eagle, little blue heron, one-toed amphiuma (*Amphiuma pholeter*), limpkin, Florida pine snake (*Pituophis melanoleucus mugitus*), swallow-tailed kite, and Eastern indigo snake (*Drymarcon couperi*). In addition, the TMS has the potential to provide a protected area for rookeries of the snowy egret, great egret, and little blue heron. With enhancement and time, the number of live cavity trees and the variety of food-bearing trees will increase. Further, the TMS will expand the existing habitat preserved in or adjacent to the Waccasassa Bay Preserve State Park and GHWMA. There is the potential that the combined area of natural and restored habitat could support species, such as the Florida black bear that was once present (Vince et al. 1989) but which have been locally eliminated or greatly reduced in abundance. At the TMS, emphasis will be placed upon maximizing species diversity and increasing carrying capacity by improving the habitat quality. The combination of habitat quality improvement and protection will increase the effective width and diversity within the existing wildlife corridor through the Waccasassa Bay Preserve State Park and GHWMA. By doing so, it also increases the number of species for which the combined area can serve as a corridor and the number of individuals that use the area for shelter during movement or refugia.

In addition to the benefits to wildlife, protection and enhancement of the TMS are expected to preserve populations of plants that are listed as Threatened or Endangered by the State of Florida. One of these (Levy pinkroot, *Spigelia loganioides*) is endemic to hydric hammocks, and two others (pinewoods dainties, *Phyllanthus liebmannianus* subsp. *platylepis* and corkwood, *Leitneria floridana*) are endemic to the Big Bend region.

By establishing the TMS, further losses of hydric and mesic hammock and degradation of remaining hammocks will be avoided. Placing this land under a conservation easement and deeding the property to the Florida Board of Trustees once the mitigation success criteria are met will ensure that this ecologically valuable natural system, unique to this region of Florida, is restored and preserved in perpetuity as an addition to the conservation lands in Levy County.

Finally, the ±851-acres No Mine Area within the Mine Parcel will be placed under a conservation easement in favor of FDEP (Attachment A). This conservation easement allows sustainable thinning and selective harvesting of pine trees (only) and prohibits the removal or destruction of native trees, shrubs or other vegetation. The easement will provide perpetual protection of seasonally flooded flow-ways on the Mine Parcel (±141 acres) with a substantial buffer of hydric and mesic hammock, thus maintaining hydrologic connectivity and over 7.5 miles of wildlife corridors from east of the Mine Parcel through the Mitigation Parcel and out to Waccasassa Bay.

SECTION 2

Existing Conditions

This section describes the existing (baseline) ecological and environmental conditions on the TMS and the No Mine Area. It summarizes the current landscape setting, topography, hydrology, soils, vegetative associations and land uses, important wildlife and listed plant resources, and known archaeological sites on the site. These baseline conditions are later compared to reference (historic) upland and wetland communities in the Gulf Hammock region to develop the goals and objectives of the mitigation plan, as well as the enhancement/rehabilitation actions necessary to restore this ecosystem.

2.1 LANDSCAPE SETTING

The mitigation site is part of the historic Gulf Hammock, once the largest area of hydric hammock in Florida (Wolfe 1990). The hammock once covered nearly 100,000 acres and stretched from the Withlacoochee River north to State Road 24 in a relatively narrow band inland from the coastal salt marshes and west of US 19. It was known for floral and faunal diversity. However, since the early 1800s, the hammock has been disturbed repeatedly beginning with selective harvesting of specific tree species (such as harvesting of eastern red cedar for pencils), and more recently, has been extensively converted to pine plantations (Wolfe 1990). Figure 2-1 and 2-2 provide historic aerials (1963 and 1970, respectively) of the hammock in its pre-development state and Figure 2-3 provides an aerial of the site as it exists currently.

2.2 TOPOGRAPHY AND HYDROLOGY

The TMS is relatively flat with elevations decreasing from about 6' NGVD at the eastern boundary to 0' NGVD at the western boundary; sheet flow generally occurs toward the west and south-southwest. Limestone is typically near the surface throughout. Within the site are parts of small flowways that carry water from east to west, providing a significant hydrologic connectivity with Waccasassa Bay and the Gulf of Mexico. The largest of these, providing a corridor through the mitigation site and eastward to several springs east of US 19, is the Spring Run system.

The region occupied by hydric hammock in the Big Bend area coincides to an area where the Floridan aquifer is unconfined (Bush and Johnson 1988 as cited in Williams et al. 2007). Discharge from the Floridan contributes to the hydrology of hydric hammocks and influences their distribution. Water levels in the hydric hammocks generally exhibit seasonal patterns that reflect those in the Floridan aquifer. Both reflect rainfall patterns (Williams et al. 2007).

The hydrology on the site has been affected by both the system of elevated roads, ditches, and culverts and the ongoing clearing activities. These have, respectively, altered sheet flow in the hammock, drained wetlands, and impounded water upstream of crossings.

The hydrology of this and other hydric hammock sites has not been thoroughly investigated. The following discussion is based on general information provided by Vince et al. (1989) and on limited observations on the mitigation site itself. Hydric hammocks, as a generality, flood occasionally, but the flood duration is short especially relative to swamps. During wet years, the water table is at or above the surface and contributes to substantial overland flow. Rainfall is the primary source of the water, though streams and discharges from the Florida aquifer may provide additional water. The extent of interaction with the Floridan aquifer is not known for this site, but this is an area mapped (Figure 2-4, Florida aquifer) as a Floridan aquifer discharge zone. The water table is known to fluctuate significantly with on-site measurements suggesting that the range

is from above-surface (during very high rainfall periods) to as much as 6' below the surface (during low rainfall periods).

2.3 SOILS

According to the Levy County Soil Survey (USDA Natural Resources Conservation Service [NRCS], 1996), two soil series characterize the hammock areas: Demory and Waccasassa sandy clay loams (Figure 2-5). Both are shallow soils underlain by limestone bedrock. Demory sandy clay loam is described as flooding occasionally while Waccasassa sandy clay loam occurs on low ridges and is described as flooding only rarely. The Demory series is associated with the hydric hammocks while the Waccasassa series is associated with more mesic hammocks. The shallow character of the soils, presence of limestone at or near the surface, and seasonally poor drainage play a major role in the nature of the plant communities that historically dominated the site. The lower portions of drainageways are characterized by Chobee fine sandy loam and salt marsh areas have cracker mucky clay sands.

2.4 VEGETATION ASSOCIATIONS/LAND USES

The vegetation on site includes both relatively natural and highly altered plant communities. For purposes of this mitigation plan, the vegetative cover types on-site (Figure 2-6) have been assigned a land use code based on the Florida Land Use, Cover and Forms Classification System [FLUCFCS: Florida Department of Transportation (FDOT), 1999] with field verification, updates, and refinement by ENTRIX field staff. The FLUCFCS cover types are generally broad, and to refine them, the sites were also classified using the ecologically based terminology developed by the Florida Natural Areas Inventory [FNAI 2009]. Site-specific data was gathered by professional biologists to identify relic natural plant communities and plant regeneration and to determine the dominant plant species occurring within each cover type (Attachment B). The majority of the tract has been converted to pine plantation or otherwise highly altered by silvicultural activities.

Most remnant natural areas are described as either mesic hammock or hydric hammock. Restoring the site to its historic Gulf Hammock habitat quality requires restoring the existing mosaic of remnant mesic and hydric hammocks and silvicultural areas to a more natural and optimal condition. The hydric hammock is subdivided into two types based on proximity to the coast. The inland version of remnant hydric hammock is the most common and occurs on the majority of the site, while coastal areas that are likely to be inundated with salty or brackish water by tropical storms are considered coastal hydric hammock. The coastal hydric hammock communities generally contain the same plant species found in the inland hydric hammocks; however, the species distribution is somewhat different. For example, eastern red cedar (*Juniperus virginiana*) and cabbage palm (*Sabal palmetto*) occur in both types of hydric hammock, but are much more prominent in the coastal communities.

Approximately 1,660 acres of pine plantations occur on the TMS and another 411.7 acres of pine plantation are present in the No Mine Area, with ages of the stands varying from 1 to 30 years. In plantations, trees were typically planted at a density of between 425 to 725 trees per acre. Individual tree heights vary from less than 8' to more than 50' high. According to 1963 aerial photographs and soil data found in the Levy County Soil Survey, most of the pine plantation acreage is located in areas that were historically coastal mesic and hydric hammocks. However, it also occurs within habitats that were forested wetlands and even in areas that have somewhat saline soils and vegetation. Without implementation of this mitigation plan, both mitigation sites are slated for continued pine production and harvesting by the current land owner.

Additional acres of “natural” forest that has been timbered or high-graded are present, especially in the western and southern parts of the TMS site. For example, the 1970 historic aerial (Figure 2-2) shows that the hydric and mesic hammocks in the entire southern portion of the TMS were clear-cut about 40 years ago.

2.4.1 Upland Vegetative Cover Types

The TMS is part of the Gulf Hammock that stretched from the Withlacoochee River northward along the coast to SR 24. The Gulf Hammock was the largest hydric hammock in Florida prior to the early 1900s. Since that time, much of the TMS has been altered, primarily by clear-cutting and conversion to pine plantation. Historic references and field review also show that the scale of variation is very fine – upland and wetland conditions may occur within the same forest type merely due to minor variations in topography and subsurface limestone. Distance from the coast, especially when combined with elevation, is also critical as low hammocks along the coast and low drainage ways leading to the coast are subject to salt water inundation during major storm events, and species incapable of tolerating occasional saline conditions are eliminated from those areas.

The descriptions that follow use the FLUCFCS terminology, but use it in combination with the terminology of Florida Natural Areas Inventory (FNAI 2009) and the NRCS (1996) to clearly distinguish between the major types of existing and historic vegetation and to provide a basis from which to develop an effective mitigation plan.

Mesic Hammocks (FLUCFCS 425- Temperate Hardwoods, 104.1 acres)

FLUCFCS 425 was used to describe the temperate hardwood forests also known as coastal mesic hammocks. On this site, they are found on shallow loamy soils over limerock and are scattered mainly along the western edge. Fire frequency is low although fire scars were noted in most areas. There is a large variety of canopy trees and a diverse flora in the understory. On the TMS, the temperate hardwood forests have an overstory characterized by cabbage palm (*Sabal palmetto*), live oak (*Quercus virginiana*), southern red cedar (*Juniperus virginiana*), laurel oak (*Q. laurifolia*), sweetgum (*Liquidambar styraciflua*), basswood (*Tilia americana*), and sugarberry (*Celtis laevigata*). Associates and understory trees include Florida maple (*Acer saccharum* subsp. *floridanum*), Hercules club (*Zanthoxylum clava-herculis*), hophornbeam (*Ostrya virginiana*), magnolia (*Magnolia grandiflora*), yaupon holly (*Ilex vomitoria*), and winged elm (*Ulmus alata*). The ground cover consists of saplings of trees, vines including poison ivy (*Toxicodendron radicans*), green briar (*Smilax bona-nox*), pepper (*Ampelopsis artemisiifolia*), and rattan vine *(Berschemia scandens*), ferns (*Thelypteris* spp.), coontie (*Zamia pumila*), grasses (*Dichanthelium commutatum, Oplismenus hirtellus*), and a variety of other herbs and small shrubs.

Mesic Hammocks [FLUCFCS 434 - Hardwood-Conifer Mixed, 22.3 acres on the TMS and FLUCFCS 425 – Temperate Hardwoods and 472 – Live Oak on the No Mine Areas, 58.0 acres]

These communities occur on the northwestern portion of the TMS and throughout the No Mine Area. They are typically surrounded by hydric hammock (FLUCFCS 630 - Wetland Forested Mixed) and Hydric Coniferous Plantation (FLUCFCS 6291 and 6292) communities. Canopy cover in these areas consists of an even distribution of mature hardwood species including live oak and laurel oak, as well as mature conifer species including slash pine (*Pinus elliottii*) and loblolly pine (*Pinus taeda*). Cabbage palm and eastern red cedar are also common in these communities. The subcanopy is predominantly composed of cabbage palm and the shrub layer is dominated by saw palmetto. Herbs are prevalent where sufficient light reaches the ground and consist of ferns (*Thelypteris* spp.), panic grasses (*Panicum* spp.), and slender woodoats (*Chasmanthium laxum)*. Density of palmetto and grassy forbs varies within each forested area. Common vines include saw greenbrier and muscadine grape (*Vitis rotundifolia*).

Coniferous Plantation, > 8 years (FLUCFCS 441, 232.6 acres)

The upland pine plantations are located in areas that were historically temperate hardwoods (FLUCFCS 425). They are currently dominated either by slash pine or by loblolly pine greater than eight years old. The

understory is typically dominated by persimmon (*Diospyros virginiana*), live oak, southern red cedar, and blackberry (*Rubus argutus*).

Forest Regeneration (FLUCFCS 443, 223.7 acres)

This category includes a diversity of areas that were once temperate hardwoods (FLUCFCS 425) and that currently are either recently cleared or planted with young pines less than 8-years-old. The canopy is either non-existent or sparse. The overstory consists of slash pines that were too young to form a closed canopy with small numbers of sweetgum, redbud, sugarberry, American elm, cabbage palms, live oaks, basswood, Hercules club, and eastern red cedar. These species were also found as shrubs. The groundcover is dominated by vines, especially greenbriar, ruderal species such as blackberry, and grasses.

Disturbed Land (FLUCFCS 740, 88.0 acres)

A network of limestone and dirt roads occur throughout the TMS. Most of these roads are elevated with ditches, swales and small borrow pits adjacent to the roads. Disturbed lands also include scraped areas around the borrow pits that are either bare or occupied by ruderal vegetation.

2.4.2 Wetland Habitat Types

Borrow Pits (FLUCFCS 530, 11.2 acres)

These are areas where material (soil and limestone) was dug for use at another location, usually the adjacent roadways. In most cases, the borrow pits fill with ground water, depending on the depth of excavation and the water table. They are often adjacent to roads and pine plantations, and may have a narrow fringe of hammock at the top of slope. These pits are often populated with nuisance species such as cattails (*Typha* sp.) in the shallow edges.

Streams and Lake Swamps (Bottomland) (FLUCFCS 615, 22.5 acres)

These wetlands occur where the freshwater flow-ways from the east enter the TMS and extend to the saline, tidally-influenced salt marshes and tidal flats along the western edge of the parcel. Typically, these habitats have an exposed limerock bed in the center of the flow-way. Sediment build up along the edges supports some cypress and a variety of water-tolerant hardwood species.

Deep Water Ponds (FLUCFCS 616a, 117.9 acres)

Many of the deep-water ponds remain inundated throughout much of the year. They are isolated during the dry season and are hydrologically connected by a slough system during the wet season. Nearly all of these areas are dominated by pop ash (*Fraxinus caroliniana*). Because these areas are inundated with deep water for extended time periods, understory vegetation is often sparse. Cover, when present, consists of species tolerant of prolonged deep inundation such as buttonbush (*Cephalanthus occidentalis*), pickerelweed (*Pontederia cordata*) and fireflag (*Thalia geniculata*). At the wetland perimeter, species diversity increases and various oaks are sometimes present.

Sloughs and Intermittent Flow-ways (FLUCFCS 616b, 131.3 acres)

These high quality, forested wetland systems typically surround deepwater ponds that remain inundated throughout most of the year and that are hydrologically connected via a slough system during the wet season.

The systems originate in swamps and are acidic, tannic colored and slow flowing. Nearly all of these areas are dominated by pop ash. This species is normally dominant in the overstory and usually located in the deepest portions of larger systems. Because these areas are inundated with deep water for prolonged periods, understory vegetation is often times greatly reduced. Cover in these areas, when present, consist of species tolerant of prolonged deep inundation such as pickerelweed and fireflag (*Thalia geniculata*). At the wetland perimeters species diversity increases and various oaks are sometimes present.

Mixed Wetland Hardwoods (FLUCFCS 617, 168.0 acres)

This plant community type contains a mixture of the hardwood tree species mentioned in the other wetland categories such as water oak (*Quercus nigra*), American elm (*Ulmus americana*), sweet-bay (*Magnolia virginiana*), red maple (*Acer rubrum*), and sweetgum. It is not dominated by a particular species, but rather exhibits a diverse mixture of species.

Cypress (FLUCFCS 621, 20.5 acres)

This habitat type is dominated by bald cypress (*Taxodium distichum*) in the canopy with coastal plain willow (*Salix caroliniana*), lance-leaved arrowhead, and sawgrass (*Cladium jamaicense*) dominating the understory.

Hydric Hammock (FLUCFCS 628 - Pine – Mesic - Oak, 102.7 acres)

This land cover type represents remnants of the hydric hammock that once dominated most of the more inland areas on this site. It contains a mixture of pines (predominantly loblolly pine), oaks (live, laurel, water, Shumard), elms, maples (red, Florida), American hornbeam (*Carpinus caroliniana*), magnolias, etc. It is variable in character depending on minor changes in topography and depth to bedrock. Better drained areas include species usually associated with uplands, such as saw palmetto (*Serenoa repens*), pignut hickory (*Carya glabra*) and redbud (*Cercis canadensis*). Inclusions of more poorly drained areas lack these species but have characteristic wetland species such as American elm and pop ash.

Hydric Coniferous Plantation > 8 years (FLUCFCS 6291, 449.5 acres)

The hydric coniferous plantations are dominated by densely planted loblolly or slash pine, sometimes bedded in shallow rows. They are typically located in areas that were historically hydric hammock. Hardwood species scattered through these plantations include red maple, laurel oak, yaupon holly, and sweetgum. The shrub stratum consists mostly of saltbush (*Baccharis halimifolia*) and the herbaceous cover consists almost entirely of weedy ruderal species.

Hydric Coniferous Plantation <8 years (FLUCFCS 6292, 1372.0 acres)

These plantations were harvested within the last 8 years. Some have been replanted with slash pine and loblolly pine; some have not yet been replanted. In areas that were not replanted, a diverse herbaceous ruderal species cover has emerged. Remaining canopy trees are few and consist mainly of laurel oak and cabbage palm. Ground cover is gradually increasing and includes dog fennel (*Eupatorium capillifolium*) and hardwood seedlings. In areas that have been replanted, the species composition is similar, but includes a densely planted immature loblolly or slash pine.

Hydric Hammock (FLUCFCS 630- Wetland Forested Mixed, 1,710.2 acres)

Wetland forested mixed communities are the most prevalent natural wetland community on the parcel. It consists of areas in which include pines and no individual hardwood species achieves dominance. Most any hardwood species typical of Mixed Wetland Hardwood Forests (FLUCFCS code 617) may occur. Mid-story trees and shrubs may be prevalent, limited to isolated clusters, or nearly absent. They may consist of young trees typical of the canopy or of larger shrubs such as wax myrtle. The ground cover is generally herbaceous

and quite variable both in its abundance and in its species composition, forming a continuous cover where the tree canopy is discontinuous and allowing ample light to reach the ground. Some vine species including muscadine grape, saw greenbrier (*Smilax bona-nox*) and blackberry are present in these areas.

Hydric Hammock, Cleared (FLUCFCS 6301 - Wetland Forested Mixed, Cleared, 43.1 acres)

These wetlands are concentrated in the northern portion of the parcel. They contain relics of a mix of hardwoods and conifers, but have been harvested. Vegetation exists mainly of emerging hardwood seedlings, dog fennel, yaupon holly, wax myrtle and coinwort.

Coastal Hydric Hammock (FLUCFCS 633 - Coastal Maritime Hammock, 382.9 acres)

Coastal hydric hammocks are adjacent to the salt marshes and tidal flats along the western side of the parcel. They are similar to the hydric hammocks that are more inland but are distinguished from them by vegetation with a higher dominance by cabbage palms, live oaks, and southern red cedar. Associates include winged elm, laurel oak, American hornbeam, yaupon holly, coontie and Hercules' club. St. Augustine grass (*Stenotaphrum secundatum*) is abundant in the groundcover. Included within this mapping unit are small areas of Coastal Mesic Hammock (FLUCFCS 425 - Temperate Hardwoods). The Coastal Hydric Hammock has been delimited from the various historic hydric hammock communities based on the eastern limit of soil mapping unit 41 in combination with signatures on recent aerial photographs. On the ground, these systems are “diffuse” in the sense that the change is gradual.

Freshwater Marsh (FLUCFCS 641, 13.1 acres)

Many of the marshes on TMS are associated with forested swamps, hammocks, or embedded within hydric pine plantations. Most of the freshwater marshes on the TMS are dominated by sawgrass.

Saltwater Marsh (FLUCFCS 642, 36.5 acres)

The majority of saltwater marshes, including tidal creek systems, are found in the southern and western portions of the TMS. They are connected to the Waccasassa Bay Preserve State Park, Demory Creek, and the Gulf of Mexico through the TMS. Salt marshes are tidal coastal ecosystems that contain dominated by non-woody salt-tolerant plants such as saltmarsh cordgrass (*Spartina alterniflora*), black rush (*Juncus romarianus*), and saltgrass (*Distichlis spicata*). Salt-tolerant shrubs including Christmas berry (*Lycium carolinianum*) and saltwater false-willow (*Baccharis angustifolia*) occur along the transitional areas.

Tidal Flats (FLUCFCS 651, 71.3 acres)

Tidal flats occur along the western half of the site, bordering Waccasassa Bay and the Gulf of Mexico. These areas are in estuaries, generally protected from wave action, and composed of silt and mud transported along tidal channels. These mud flat communities are largely unvegetated. They are associated with the tide, and thus are alternately submerged and then exposed to the atmosphere.

2.5 WILDLIFE

Wildlife biologists from ENTRIX visited the site regularly during 2005, 2006, 2007 and 2008 and any wildlife species observed during this period were recorded. Efforts were concentrated on establishing a list of wildlife currently occurring on the site and on determining suitable habitat for listed species. Listed species observed on the site include little blue heron (*Egretta caerulea*), white ibis (*Eudocimus albus*), American alligator (*Alligator mississippiensis*), bald eagle (*Haliaeetus leucocephalus*), wood stork (*Mycteria americana*), limpkin (*Aramus guarauna*), and snowy egret (*Egretta thula*). A little blue heron roost and a white ibis roost were also observed on the site. Pairs of swallow-tailed kites (*Elanoides forficatus*) were observed, and they may be breeding on the site though nests were never located. More formal wildlife

surveys were conducted from August 2007 through June 2008 to identify the presence and abundance of a variety of species. A detailed accounting of sampling methodology and results is provided in the Tarmac King Road Limestone Mine Wildlife Survey Results report (revised July 2009).

2.6 LISTED PLANT SPECIES

State listed rare plant species have been observed on the mitigation site. These include corkwood (*Leitneria floridana*), which occurs in moderately deep ponds, mostly near the coast; brown-eyed susan (*Rudbeckia triloba*), which is abundant in recently cleared areas with clayey soils; pinewoods dainties (*Phyllanthus liebmannianus* subsp. *platylepis*); and anglepod (*Matelea gonocarpus*), which was seen in several areas of older pine plantation and natural hammock.

2.7 ARCHAEOLOGICAL RESOURCES

In June 2008, Florida History, LLC completed the *Cultural Resource Management Plan for the Tarmac Mine Mitigation Area*. It states that there are three known archeological sites within the boundaries of the mitigation area. It proposes management measures to ensure these sites are not disturbed. The Florida State Historic Preservation Officer issued a letter approving the plan on August 20, 2008.

SECTION 3

Goals and Objectives

The objective of this mitigation plan is to compensate for unavoidable impacts to wetlands in the Waccasassa River basin (Figure 3-1) as a result of construction of the Tarmac King Road Limestone Mine Project. A majority of the proposed impacts of this limestone mine will be to hydric pine plantation and wetlands that have been disturbed by silviculture and silviculture-related activities such as ditching, and road building and maintenance. On the Mine Parcel and the TMS, all forested wetlands that are too deep for planting in pine (and currently appear to be of relatively high quality) are scheduled to be clear-cut by the current landowner.

The ecological restoration/enhancement described herein is designed to restore the pre-pine plantation/historical communities to the project site. Specifically, it entails the restoration of the total mosaic of natural plant communities on the site. The proposed ecological goals for restoration are threefold.

1. Recreate the landscape mosaic as it appears on 1963 aerial photographs (Figure 2-1). The 1963 landscape was that which existed immediately preceding intensive silviculture conversion activities.

2. Re-establish the species composition and structure of the 1963 plant communities. The communities will resemble reference communities in the coastal Big Bend region of Florida on similar soils and at similar elevations above sea level with respect to life form distribution, vertical stratification, overall special abundance, and patterns of dominance.

3. To the extent practicable and without impacting off-site property owners, rehabilitation efforts will return natural patterns of surface run-off by filling ditches and erosion areas, eliminating raised roads, installing equalizer culverts under and creating hardened low water crossings in permanent roads.

Achieving the primary goal of restoring the existing plant communities to the historic natural conditions in the Gulf Hammock is based on review of the best available information from the literature (Section 3.1) and a quantitative study of reference wetlands and uplands in the vicinity of the project area (Section 3.2). A map of the target restoration plant communities is provided as Figure 3-2.

3.1 HISTORIC CONDITIONS

The mitigation sites lie within the Gulf Hammock region which was formerly dominated by the largest hydric hammock in Florida. While typically described as a single system due to the predominance of the hydric hammock, variety was present in the form of some drier mesic hammock areas and some deeper wetlands and drainageways. The historic condition is shown in Figure 2-1, an aerial from 1963. By 1970 (Figure 2-2) the southern portion of the TMS had been clear-cut but the remainder was mostly natural.

3.1.1 Vegetation

The vegetation of the mitigation area was historically dominated by hydric hammock with some better drained areas supporting mesic hammock and drainageways and pockets in the limestone supporting vegetation characteristic of longer-hydroperiod, deeper wetlands. Available information sources are general and do not clearly distinguish between all community types, especially between hydric and mesic areas. To complement the available data, ENTRIX sampled all major community types proposed for enhancement/restoration (Attachment B). The ENTRIX data is local as it is derive from sampling the best remaining natural communities on and adjacent to the mitigation sites. It is limited in that some of the sampled sites have been altered by past (1950s) clearcutting and by timbering (highgrading) operations. The

ENTRIX study also suggests that these variants may represent ends of a continuum and that there is no clear demarcation between these variants.

3.1.1.1 Hydric Hammock – Inland Variant

Hydric hammocks in the Gulf Hammock are dominated by cabbage palm, live oak, swamp laurel oak, red maple, and loblolly pine. American elm is common. Hornbeam (musclewood, blue-beech) dominates the understory. The understory is typically open but may have greenbriar and dwarf palmetto. There is typically little herbaceous groundcover (description from Vince et al. 1989). Historically, this was the most common forest cover type on the mitigation sites.

3.1.1.2 Hydric Hammock – Coastal Variant

The coastal variant is similar, but the canopy is largely restricted to cabbage palm, live oak and eastern red cedar (Vince et al., 1989). Limestone is at or near the surface. St. Augustine grass is highly abundant in the groundcover (Simons et al., 1989). Remnants of this forest cover type occur in the western part of the TMS, especially toward the south.

3.1.1.3 Mesic Hammock – Inland Variant

The hydric hammock grades into mesic hammock in areas with slightly higher elevation. These forests were dominated by oaks, especially live oak. The character distinguishing mesic hammock from hydric hammock is the presence of pignut hickory, southern magnolia, white ash, hop hornbeam, winged elm, red bay, dogwood, and Hercules club.

The canopy is typically closed and dominated by live oak, with cabbage palm generally common in the canopy and subcanopy. Southern magnolia and pignut hickory may be occasional in the subcanopy. Water oak and laurel oak are frequent in this community. Deciduous species such as sweetgum and sugarberry are found in the canopy and subcanopy layers. The understory includes a more diverse array of species than is found in the hydric hammocks including saw palmetto, beautyberry, American holly, gallberry sparkleberry, common persimmon, highbush blueberry, Carolina laurel cherry, yaupon holly, and wax myrtle. The herb layer is often sparse or patchy and consists of various grasses, including low panic grasses, witchgrasses, woodsgrass, longleaf woodoats, sedges, and whip nutrush, as well as various ferns and forbs such as bracken fern and partridgeberry (description adapted from FNAI 2009).

Remnants of this forest cover type occur on the Mine Parcel, and very small areas remain in the No Mine Area conservation corridors within the mine site.

3.1.1.4 Mesic Hammock – Coastal Variant

Coastal mesic hammocks are similar to the more inland ones but contain considerable amounts of red cedar and fewer species than those present further inland (Monk 1965). Platt and Schwartz (1990), who provide descriptive information based on the available literature, point out that there are more evergreen species in the coastal variants of mesic hammocks and that these hammocks may have a diverse flora of ferns, especially on limestone outcrops.

3.2 REFERENCE WETLANDS AND UPLANDS

As obvious from the descriptions provided above, there is limited detail available in the literature on these hammock systems. It is also evident that there is substantial local variation. Given this, a site-specific study of the hammocks in the vicinity was developed to act as local references to capture the character of the hammocks in the vicinity of the mitigation site. This study also looked at the existing condition of altered (logged and sometimes replanted) areas to determine the extent to which natural succession might need to be supplemented in order to bring the mitigation area back to an approximation of its historic condition. To the

extent feasible, the reference wetlands are systems that remain unaltered, and include systems immediately to the west in the Waccasassa Bay Preserve State Park and immediately off-site further inland. They also include areas that remain uncut on the site itself and areas in the southern part of the site that were cut prior to 1970, not converted to pine plantation and that have now had over 40 years to recover.

Pine plantations occur on the mitigation sites with ages of the stands varying from 1 to 30 years. Additional acres of "natural" forest that has been timbered or high-graded is present, especially in the western and southern parts of the site. In plantations, trees were typically planted at a density of between 400 to 725 trees per acre. Individual tree heights vary from less than 8-ft to more than 50-ft high. According to 1943 aerial photographs and soil data presented in the Levy County Soil Survey, the pine plantations are mostly located in areas that were historically coastal mesic and hydric hammocks, but are also planted in sites that were historically forested wetlands and even in areas that have somewhat saline soils and vegetation. This section provides a summary of least disturbed natural systems; full detail can be found in Attachment B.

Species cited in the literature as occurring 80% or more of the time in natural forest included *Vaccineum elliottii, Ilex myrtifolia, Cornus florida, Leitneria floridana, Gleditsea aquatica, Carya aquatica, Persea borbonea, Fraxinus caroliniana, Lyonia ferruginea, Serenoa repens, Crataegus* spp., and *Carpinus caroliniana*. If these species are to occur in restored forests, they will likely need to be planted.

Species strongly associated with disturbance (occur in natural forest 20% or less of the time) included *Polypremum procumbens, Oxalis corniculata, Eupatorium capillifolium, Acer negundo, Morus rubra, Baccharus halimifolia, Diodia virginiana, Cercis canadensis, Vitis cinerea, Andropogon glomeratus, Melanthera nivea, Pinus elliottii, Melothria pendula, Iris hexagona, Ambrosia artemisiifolia,* and *Callicarpa americana*. Many of these are typically considered to be early successional weedy species. Others, however, such as *Morus rubra, Vitis cinerea* and *Callicarpa americana*, were likely brought in from elsewhere by birds. *Pinus elliottii* was likely brought in purposefully for plantation regeneration. In all cases, these species will eventually disappear as restored areas mature into closed-canopied forests. Unless out-competing other species, none should need to be actively controlled.

3.2.1 Uplands

3.2.1.1 Mesic Hammock

Mesic Hammock occurs in better drained areas. These were mapped as FLUCFCS 425, FLUCFCS 427, or FLUCFCS 434 depending on the relative dominance of canopy species (Figure 2-6). On the Tarmac King Road Mine, they are found on shallow loamy soils over limerock. Fire frequency is low although fire scars were noted in many areas.

This community type was characterized by high species richness (32 species were observed in the overstory, 35 in the understory, 42 in the shrub layer, and 93 in the groundcover). On the Tarmac King Road Mine, the temperate hardwood forests have an overstory characterized by sabal palm (*Sabal palmetto*), laurel oak (*Quercus laurifolia*), water oak (*Q. nigra*), blue-beech (*Carpinus caroliniana*), basswood *(Tilia americana)*, sweet-gum (*Liquidambar styraciflua*), live oak (*Q. virginiana*), slash pine *(Pinus elliottii)*, pignut hickory (*Carya glabra*) and eastern red cedar (*Juniperus virginiana*). Uncommon but distinctive species included hornbeam *(Ostrya virginiana)*, Shumard oak (*Q. shumardii*), white oak *(Q. alba)*, southern magnolia (*Magnolia grandiflora*), and white ash (*Fraxinus americana*). The most typical understory trees include Hercules' club (*Zanthoxylum clava-herculis*), blue-beech, water oak, American elm *(Ulmus americana)* pop ash *(Fraxinus caroliniana)*, winged elm *(Ulmus alata)*, hawthorn (*Crataegus spathulata* and *Crataegus* sp.), cornel (*Cornus foemina*), yaupon holly *(Ilex vomitoria)* and laurel oak. The Hercules' club was found predominantly in the one site sampled that was highly coastal in character. Other uncommon but characteristic species included flowering dogwood (*Cornus florida*) and flatwoods plum (*Prunus umbellata*). The shrub layer was dominated by smaller individuals of the same species including sabal palm, yaupon holly, and Florida maple. Saw palmetto (*Serenoa repens*) was the most common shrub species. Other shrubs

that were characteristic but not common include small flowered false-buckthorn (*Sageretia minutiflora*), beautyberry (*Callicarpa americana*), gum bumelia (*Sideroxylon languinosum*), groundsel bush (*Baccharus glomerulifolia, B. halimifolia*), and American strawberry-bush (*Euonymus americanus*). The ground cover consists of saplings of trees, vines, and a variety of ferns, grasses, and herbs. The most abundant species were greenbriers *(Smilax auriculata, S. bona-nox)*, fern *(Thelypteris hispidula* var. *versicolor)*, poison ivy (*Toxicodendron radicans*), sabal palmetto, and panic grass. Less common but distinctive species included ovate maiden fern *(Thelypteris ovata)*, crossvine (*Bignonia capreolata*), slender woodoats *(Chasmanthium laxum)*, rattanvine (*Berchemia scandens*), frostweed (*Verbesina virginica*), climbing anglepod *(Matelea gonocarpos)*, and pinewood dainties *(Phyllanthus liebmannianus* subsp. *platylepis)*. This description is based on seven transects through relatively unaltered areas. It is probable that more loblolly pine may have been present historically since there was evidence of high grading in some of the sampled areas.

The mesic hammock on this site varies in character being somewhat intermediate in character between the classic mesic hammock described in Section 3.1 and hydric hammock. The canopy has a high component of species characteristic of hydric hammock, the shrub layer was generally absent except for small individuals of overstory species, yet the groundcover layer is more characteristic of mesic hammock and soils in these areas were not hydric.

Many of the species most common in mesic hammocks are also present in pine plantations planted in areas that were originally hammock. The relative abundance, both in terms of density per acre and in terms of percent of stems, differs between natural and pine plantation areas even where the species are present in both. The pine plantations tend to have lower species richness in the canopy and subcanopy strata, but higher species richness in the groundcover– mostly due to species tolerant of disturbance.

With the exception of two exotic species, disturbance species can be expected to decrease in abundance with time. Cogongrass and Japanese honeysuckle should be eradicated if found in preservation or restoration areas. Species not observed reproducing, or reproducing only in low abundance, that should be planted to hasten the succession in pine plantation areas include Shumard oak, red bay, southern magnolia, sweet-bay, climbing anglepod, saw palmetto, and ovate maidenfern. Slash pine and loblolly pine should be thinned where their abundance exceeds their abundance in the natural community by 5% and 10%, respectively.

3.2.1.2 Coastal Mesic Hammock-Temperate Hardwoods

Inadequate coastal mesic hammock (one transect) was available to sample separately from the upland mesic hammock discussed above. This hammock was mapped as FLUCFCS 425. The species composition is similar to that of the upland mesic hammocks (and included in the species description above). Differences, while minor overall, include higher abundances of coontie (*Zamia pumila*), Hercules' club, and eastern red cedar.

3.2.2 Wetlands

3.2.2.1 Hydric Hammock

This vegetative cover type represents remnants of the hydric hammock that once dominated most of the more inland areas on this site. It is characterized by a diverse canopy (29 species recorded on transects) consisting primarily of a pine-hardwood canopy dominated by loblolly pine *(Pinus taeda)* and various oaks (predominantly laurel and live oak). Also abundant are water locust (*Gleditsia aquatica*), pop ash (*Fraxinus caroliniana*), eastern red cedar (*Juniperus virginiana*), sweet-gum *(Liquidambar styraciflua)*, sabal palm (*Sabal palmetto*), sweet-bay (*Magnolia virginiana*), and American elm (*Ulmus americana*). The subcanopy and shrub layers are also diverse (42 and 34 species respectively, recorded on the transects) and contain mostly the same species plus a variety of smaller species including Florida maple (*Acer saccharum* subsp. *floridanum*), yaupon holly, and American hornbeam (*Carpinus caroliniana*). This community is variable in character depending on minor changes in topography and depth to bedrock. Small inclusions of better drained

areas include species usually associated with uplands, including some saw palmetto (*Serenoa repens*), pignut hickory (*Carya glabra*) and redbud (*Cercis canadensis*). Inclusions of more poorly drained areas have a greater abundance of characteristic wetland species such as American elm and pop ash. The groundcover is fairly sparse and not highly diverse. It consists primarily of woody seedlings, vines, and a few shade-tolerant grasses. Most abundant groundcover species are associated predominantly with wetlands. The areas sampled were disturbed to some degree. It is probable that there have been shifts in canopy dominance due to high-grading (selective logging).

Most of the characteristic species were also found in young pine plantations and cleared areas. Exceptions included water locust and water hickory which were absent or under-represented. There was little consistency in what was present or absent in the three altered community types sampled; that is, clear successional patterns were not apparent. However, the altered areas consistently included more red maple (*Acer rubrum*), boxelder (*Acer negundo*), and groundsel bush (*Baccharus halimifolia*). The plantations had more pine than found in the natural communities.

In its natural state, this community type was mapped as FLUCFCS 630 on the land use map.

3.2.2.2 Hydric Coastal Hammock

Hydric coastal hammocks occur along the western side of the tract and are sufficiently close to the Gulf that they are inundated by salty or brackish water during extreme storm events with storm surges, which are pushed inland by storm winds and tides. They are similar to the hydric hammocks that are more inland but are distinguished from them by vegetation with a higher dominance by cabbage palms and eastern red cedar (*Juniperus virginiana*). Associates include winged elm, laurel oak, blue-beech and yaupon holly. St. Augustine grass (*Stenotaphrum secundatum*) is abundant in the groundcover. Included within this mapping unit are small areas of coastal mesic hammock. The hydric coastal hammock was delimited from the hydric hammock based on the eastern limit of soil mapping unit 41 (Figure 2-5) in combination with signatures on recent aerial photographs. On the ground, these systems are “diffuse” in the sense that the change between them is gradual. Based on information contained in Wolfe (1990), the delineation represents the saline water inundation level during tropical storm events (a hurricane could push saline water further inland).

Hydric coastal hammock are mapped as FLUCFCS 633 on the land cover map.

3.2.2.3 Hydric Oak Hammocks

This community type mostly occurs in low flatlands inland of the coastal zone. It is dominated by laurel, water, and live oaks with a substantial component of sweet-gum and red bay. The subcanopy was more diverse and in addition to the species found in the canopy, included winged elm, blue-beech, yaupon holly and Florida maple in abundance. The shrub layer included abundant wax myrtle and small sabal palms. The groundcover was sparse and consisted mostly of vines and small woody plants of the same species in the higher strata, likely due to low light conditions. These hydric oak hammocks were generally mapped as FLUCFCS 628 on the cover type map. The one transect in a cleared area had previously been pine plantation and the original plant community was hard to determine.

SECTION 4

Compensatory Mitigation Plan – Proposed Conditions

The planned mitigation and restoration/enhancement (rehabilitation) efforts involve restoring the TMS and No Mine Areas to the pre-pine plantation/historical communities. Specifically, efforts entail the restoration/enhancement of approximately 1,821.6 acres of wetlands and 456.2 acres of uplands to the historical (reference) Gulf Hammock community type described in Section 3. To obtain success, the rehabilitated communities will resemble reference communities with respect to life form distribution, vertical stratification, overall plant size, species abundance, and patterns of dominance. The rehabilitation will focus on three levels of diversity: 1) landscape mosaic, 2) plant community structure, and 3) plant species composition. In addition, all remaining wetlands (2,841.4 acres) and uplands (184.39 acres) that are relatively intact on the two sites will be preserved.

4.1 MATRIX OF EXISTING TO POST-RESTORATION LAND USES AND ACREAGES

Tables 4-1 and 4-2 below provide a detailed acreage correlation of current community types to post-restoration community types on the TMS and No Mine Area of the Mine Parcel, respectively. The actual acreage of each community type is less important than achieving a healthy, integrated mosaic of communities with approximately these percentages (acreages) of component communities.

Table 4-1 Matrix of Existing to Post Restoration Land Uses for Tarmac Mitigation Parcel (shaded areas represent enhancement targets)

	Post-Restoration Land Use											
FLUCFCS Existing Types	Borrow Pits	Coastal Hydric Hammock	Coastal Mesic Hammock	Cypress	Deep Water Ponds	Freshwater Marsh	Hydric Hammock	Mesic Hammock	Roads	Saltwater Marsh	Stream & Lake Swamps	Tidal Flats
530 - Borrow Pits	11.20											
633 - Coastal Hydric Hammock		382.93										
425 - Temperate Hardwood			78.90									
441 - Coniferous Plantation			35.49									
621 - Cypress				20.52								
616a - Deep Water Ponds					101.37							
641 - Freshwater Marsh						13.05						
617 - Mixed Wetland Hardwoods							124.65					
628 - Pine - Mesic - Oak							20.69					
6291 - Hydric Coniferous Plantation > 8							345.01					
6292 - Hydric Coniferous Plantation < 8							1314.61					

630 - Wetland Forested Mixed							1601.21					
6301 - Wetland Forested Mixed - Cleared							43.13					
425 - Temperate Hardwood								25.18				
434 - Hardwood Conifer Mixed								22.35				
441 - Coniferous Plantation								136.03				
443 - Forest Regeneration								33.23				
740 - Roads									86.67			
642 - Saltwater Marsh										36.51		
615 - Streams and Lake Swamps (Bottomland											22.46	
651 - Tidal Flats												71.30
TOTAL	11.20	382.93	114.40	20.52	101.37	13.05	3449.31	216.80	86.67	36.51	22.46	71.30

Table 4-2 Matrix of Existing to Post Restoration Land Uses for Tarmac No Mine Parcel (shaded areas represent enhancement targets)

FLUCFCS Existing Types	Borrow Pits	Deep Water Ponds, Sloughs & Intermittent Flowways	Hydric Hammock	Mesic Hammock	Roads
425 - Temperate Hardwood				73.97	
427 - Live Oak				0.14	
441 - Coniferous Plantation				64.36	
443 - Forest Regeneration				190.41	
530 - Borrow Pits	0.22				
616 - Deep Water Ponds/Sloughs and Intermittent Flowways		155.03			
617 - Mixed Wetland Hardwoods			42.74		
628 - Pine - Mesic - Oak			78.25		
6291 - Hydric Coniferous Plantation > 8			96.5		
6292 - Hydric Coniferous Plantation < 8			56.2		
630 - Wetland Forested Mixed			92.67		
740 - Roads					1.33
TOTAL	0.22	155.03	366.36	328.8	1.33

4.2 PROPOSED ENHANCEMENT AND REHABILITATION ACTIVITIES

Tables 4.1 and 4.2 above quantify altered habitats on the two mitigation areas that are proposed for enhancement and rehabilitation activities. Within these active restoration areas the following enhancement activities are proposed:

1. Implementation of monitoring in accordance with the procedures provided in Attachment C (Monitoring Plan).

2. Cessation of any further silvicultural activities not directly related to restoration (Note: the proposed conservation easement for the No Mine Area allows sustainable selective thinning of pine trees only and prohibits the removal or destruction of other native trees, shrubs or other native vegetation. Thus, the No Mine Area is expected to succeed to native hammock).

3. Thinning of planted pine to no more than five percent of total tree stems for slash pine or ten percent for loblolly pine tree.

4. As determined by quantitative and qualitative monitoring results (Attachment C), supplemental planting of the species listed in Attachment D (Table D-1) in areas with less than 300 tree stems per acre or less than 200 shrub stems per acre to meet these minimum requirements. Supplemental planting also will occur if less than 80% of the species in the target community type (Table D-1) are detected with a focus on those species that are most under represented by monitoring. These focal species will be planted in loose groupings of 10-12 individual plants to ensure that all planted obligate out crossing species will be pollinated. The goal of this latter effort is to inoculate the community type with a broad spectrum of representative species that can successfully reproduce and colonize the remainder of the plant community in the future.

5. Exotic and nuisance species control in accordance with the procedures listed in Attachment E, Exotic and Nuisance Species Control Plan. In addition, any native opportunistic species, particularly vines such as *Vitis* spp., *Smilax* spp., *Rubus argutus*, and *Mykania scandens* that occur in densities such that they impede the survival of the mitigation target community species will be removed.

6. If bedded areas are encountered during pine removal activities, they will be regraded to match the ground elevation of any surrounding hammock restoration areas where bedding has not occurred.

7. If warranted, localized burning may be used to remove piles of logging debris. As hammocks are believed to burn only rarely, fire will not be used on the site as a whole.

Proposed success criteria for the mitigation areas are provided in Attachment F.

4.3 OTHER WETLAND COMMUNITIES (434.5 ACRES)

Other existing wetland communities typically found associated with the Gulf Hammock mixed hardwood systems will remain post-reclamation, as detailed in Tables 4.1 and 4.2. They include: Deep Water Ponds, Cypress, Streams and Lake Swamps, Sloughs and Intermittent Flow-ways, Borrow pits, Saltwater Marsh and Tidal Flats. Detailed descriptions of these communities can be found in Section 2.4.2 of this plan. Of the total 434.5 acres of other wetlands preserved, 158.1 acres occur within the No Mine Area of the Mine Parcel and the remaining 276.4 acres occur within the TMS. As these community types are largely intact, no active restoration is required or proposed.

4.4 HYDROLOGIC ENHANCEMENT ACTIVITIES

Hydrologic enhancement activities are proposed for the mitigation parcel in order to restore historic sheet flow and hydrology on the TMS back to a more natural state reminiscent of the site's condition before systems of roads, ditches, and culverts were installed to support logging activities. Currently, on-site conditions exist that have been altering the hydrology on the TMS. Proposed improvement activities include ditch blocks in strategic locations, installations of low water crossings, and culvert repairs. A detailed hydrologic enhancement plan is provided as Attachment G of this Mitigation Plan. All work covered by this plan will adhere to the Turbidity Management Plan (Attachment H).

4.5 MANAGEMENT OF THE MITIGATION AREAS

Until all final permit success criteria have been met, the permittee will retain a Qualified Mitigation Supervisor (QMS) to oversee all mitigation activities, as described in Attachment I. The QMS will employ adaptive management[2] in all decisions to fulfill these obligations. Any required fire management will be in accordance with Attachment J. Attachment K governs security, hunting and recreational activities on the mitigation lands.

[2] Adaptive Management: The development of a management strategy that anticipates likely challenges associated with compensatory mitigation projects and provides for the implementation of actions to address these challenges, as well as unforeseen changes to these projects. It requires consideration of the risk, uncertainty, and dynamic nature of compensatory mitigation projects and guides modification of these projects to optimize performance.

SECTION 5 Restoration Plan Schedule

Mitigation credits are produced through five different post-reclamation target community types: (1) upland preservation - mesic hammock and coastal mesic hammock; (2) wetland preservation - hydric hammock, coastal maritime hammock and all other native wetland communities; (3) mesic hammock restoration; (4) coastal mesic hammock restoration; and (5) hydric hammock restoration. The Uniform Mitigation Assessment Method (UMAM) was used to calculate the Relative Functional Gain (RFG) and number of credits for each mitigation type (Figures 5-1 and 5-2). Based on the work proposed herein, it is anticipated that the mitigation plan will yield 897.26 USACE UMAM credits to be released according to the following schedule:

	Credits
Year 1 - Credit from Wetland Preservation and Hydrologic Enhancement Areas	413.65
Year 15 - Achieve Success on Hydric Hammock restored from hydric coniferous plantation >8 yrs	102.29
Year 30 – Achieve Success on acres of Hydric Hammock restored from hydric coniferous planation <8 yrs and cleared mixed hardwood forest	381.32

Figures 5-3 and 5-4 depict the release schedule by year. Attachment L summarizes mitigation cost estimates for the project.

SECTION 6

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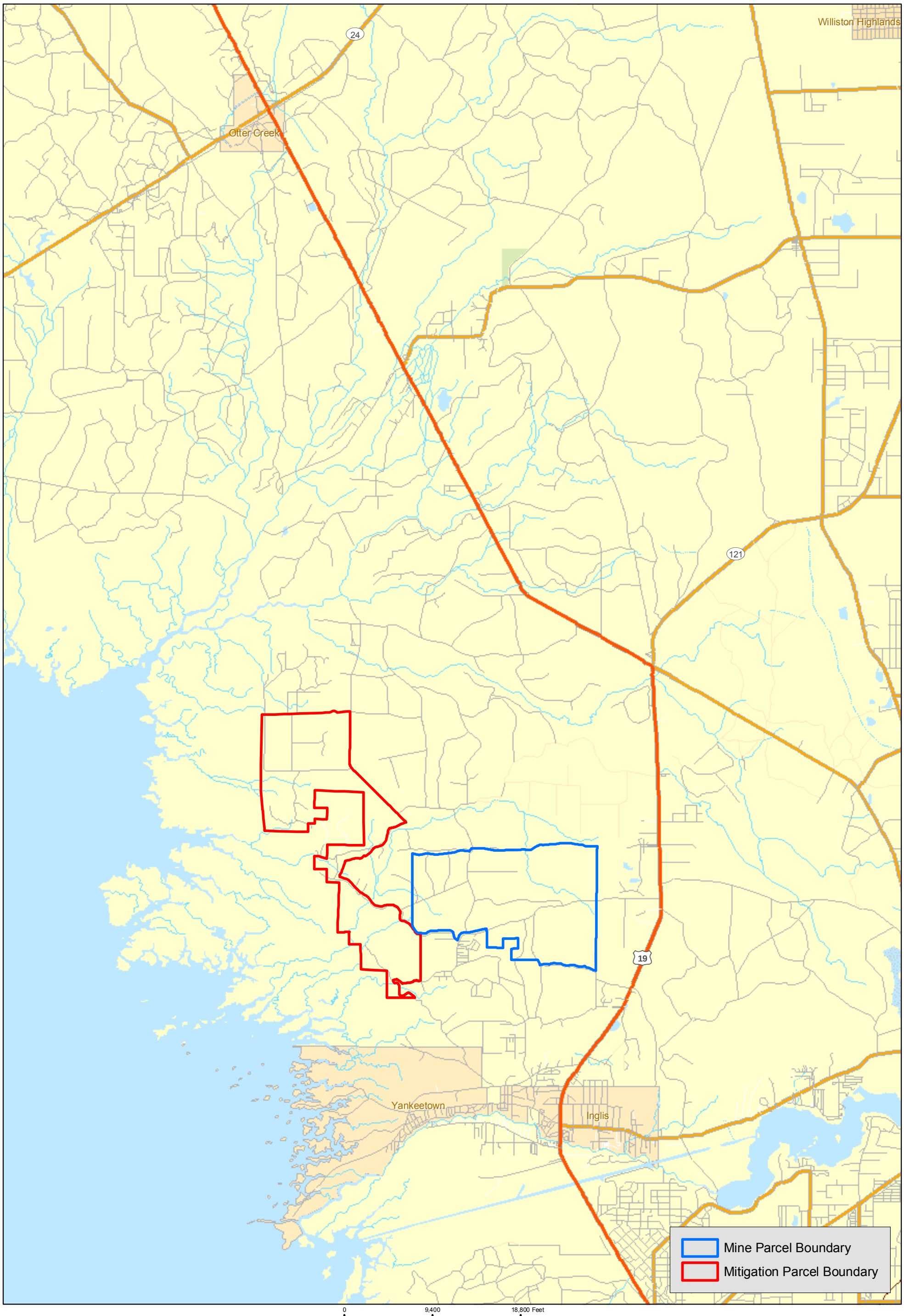

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Figure 1-1
Location Map

Tarmac King Road Limestone Mine
Levy County, Florida

Image:Base

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East Bronson
Otter Creek
Williston Highlands
Yankeetown
Inglis

Map Label	Name
1	LOWER WACCASASSA CONSERVATION AREA
2	UPPER WACCASASSA CONSERVATION AREA
3	JACK AND LOY ANN MANN CONSERVATION EASEMENT
4	DAVID AND SARAH MEEKS CONSERVATION EASEMENT
5	USHER TRUST CONSERVATION EASEMENT
6	CEDAR KEY SCRUB STATE RESERVE
7	NATC SUWANNEE SWAMP CONSERVATION EASEMENT
8	FELBURN PARK
9	GOETHE STATE FOREST
10	NATC GULF HAMMOCK CONSERVATION EASEMENT
11	MARJORIE H. CARR CROSS FLORIDA GREENWAY STATE RECREATION AND CONSERVATION AREA
12	WACCASASSA BAY PRESERVE STATE PARK

Mine Parcel Boundary
Mitigation Parcel Boundary
No Mine Areas
Managed Lands

SRWMD LANDS

ACQUIRED
CONSERVATION EASEMENT

Public Owned Conservation Easements

GOETHE STATE FOREST
WACCASASSA BAY PRESERVE STATE PARK

0 3 6 Miles
0 4,100 8,200 Meters

Figure 1-2
Conservation Lands Location Map

Tarmac King Road Limestone Mine
Levy County, Florida

Image:Base

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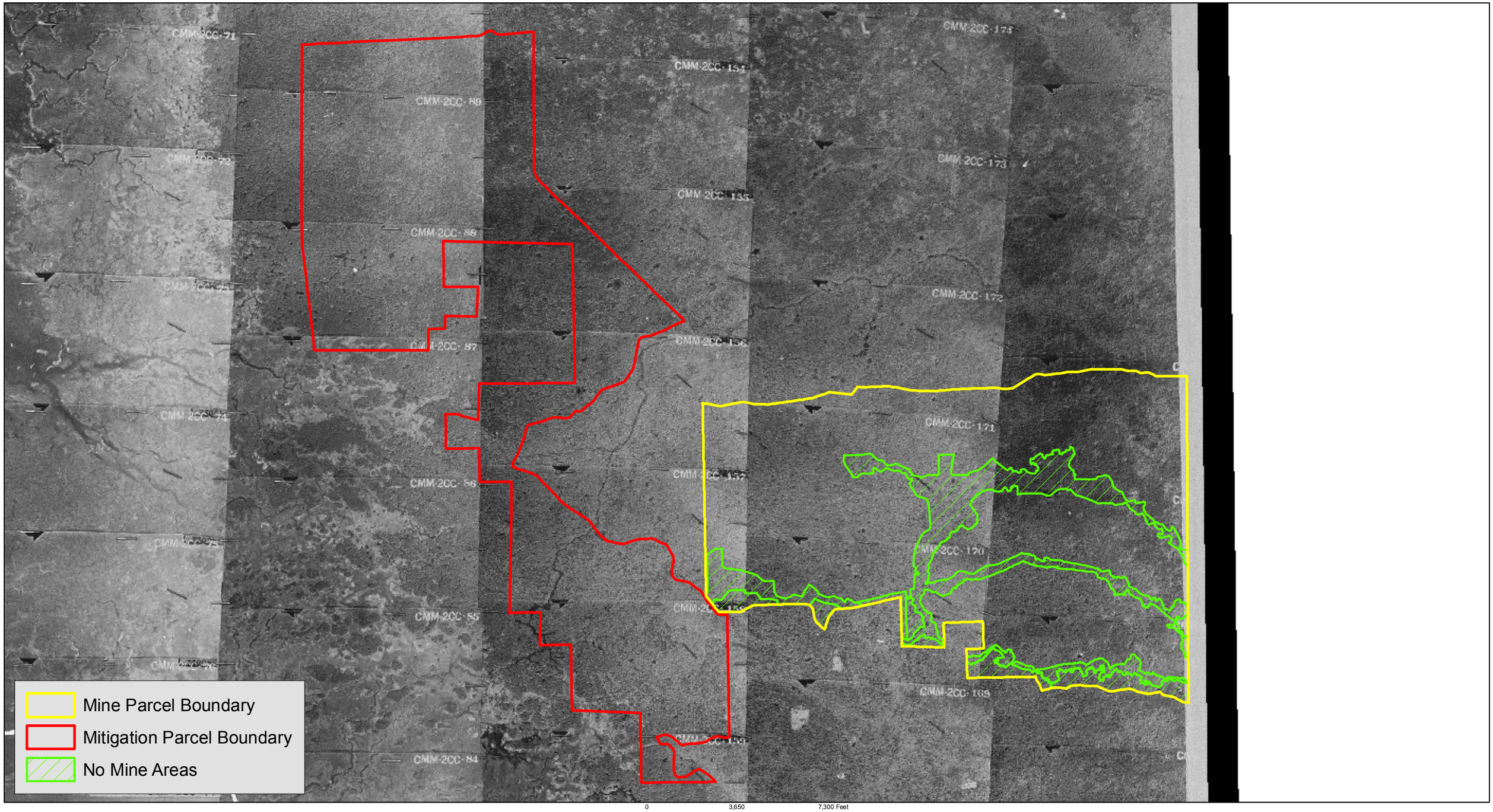

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Figure 2-1
1963 Historic Aerial

Tarmac King Road Limestone Mine
Levy County, Florida

Image: 1963

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Mine Parcel Boundary

Mitigation Parcel Boundary

No Mine Areas

0 3,650 7,300 Feet

0 870 1,740 Meters

Figure 2-2
1970 Historic Aerial

Tarmac King Road Limestone Mine
Levy County, Florida

Image: 1970

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Mine Parcel Boundary

Mitigation Parcel Boundary

No Mine Areas

0 3,650 7,300 Feet

0 870 1,740 Meters

Figure 2-3
2009 Aerial

Tarmac King Road Limestone Mine
Levy County, Florida

Image: 2009

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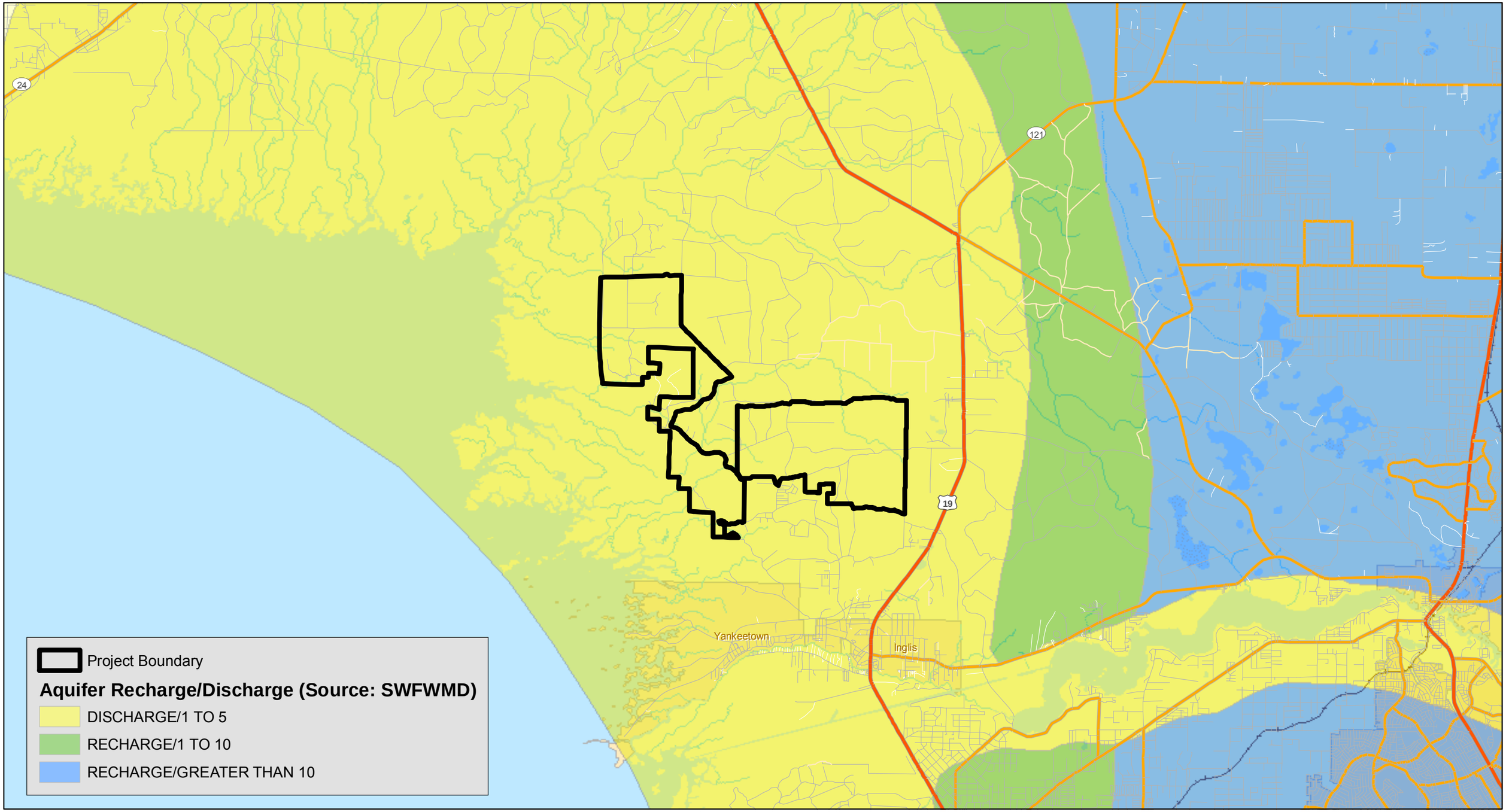

Figure 2-4 - Aquifer Discharge Zone

Tarmac King Road Limestone Mine
Levy County, Florida

Image:2007 IR

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Date: 02/17/2010 Rev. Date: n/a PM: MEE GIS Analyst: JBR Map Document: aquifer_20100217.mxd Project Number: 7856-001 PDF Document: aquifer_20100217.pdf Plot Size: 11x17

Mine Parcel Boundary
Mitigation Parcel Boundary

NRCS Soils

- 013 - WEKIVA FINE SAND 1,254.5 ac.
- 025 - PITS AND DUMPS 22.2 ac.
- 039 - WACCASASSA-DEMORY COMPLEX; FLOODED 6,781.2 ac.
- 041 - DEMORY SANDY CLAY LOAM; OCCASIONALLY FLOODED 949.2 ac.
- 045 - CRACKER MUCKY CLAY; FREQUENTLY FLOODED 45 ac.
- 046 - CHOBEE FINE SANDY LOAM; LIMESTONE SUBSTRATUM; FREQUENT 222.3 ac.
- 099 - WATER < 40 ACRES 2.3 ac.

0 3,650 7,300 Feet
0 870 1,740 Meters

Figure 2-5
NRCS Soils Map

Tarmac King Road Limestone Mine
Levy County, Florida

Image: 2009

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Mine Parcel Boundary

Mitigation Parcel Boundary

FLUCFCS

- 425 - Temperate Hardwood - 221.9. ac. +/-
- 427 - Live Oak - 45.5 ac. +/-
- 434 - Hardwood Conifer Mixed - 22.3 ac. +/-
- 441 - Coniferous Plantation - 1,159.2 ac. +/-
- 443 - Forest Regeneration - 1,029.4 ac. +/-
- 530 - Borrow Pits - 22.2 ac. +/-
- 615 - Streams and Lake Swamps (Bottomland) - 22.5 ac. +/-
- 616a - Deep Water Ponds - 252.1 ac. +/-
- 616b - Sloughs and Intermittent Flow-ways - 154.3 ac. +/-
- 617 - Mixed Wetland Hardwoods - 283.2 ac. +/-
- 621 - Cypress - 21.7 ac. +/-
- 628 - Pine - Mesic - Oak - 234.0 ac. +/-
- 6291 - Hydric Coniferous Plantation > 8 yrs - 1,466.3 ac. +/-
- 6292 - Hydric Coniferous Plantation < 8 yrs - 1,810.4 ac. +/-
- 630 - Wetland Forested Mixed - 1,885.3 ac. +/-
- 6301 - Wetland Forested Mixed - Cleared - 43.1 ac. +/-
- 633 - Coastal Maritime Hammock - 382.9 ac. +/-
- 641 - Freshwater Marsh - 13.1 ac. +/-
- 642 - Saltwater Marsh - 36.5 ac. +/-
- 651 - Tidal Flats - 71.3 ac. +/-
- 740 - Roads - 99.7 ac. +/-

0 3,650 7,300 Feet

0 870 1,740 Meters

Figure 2-6
FLUCFCS Map

Tarmac King Road Limestone Mine
Levy County, Florida

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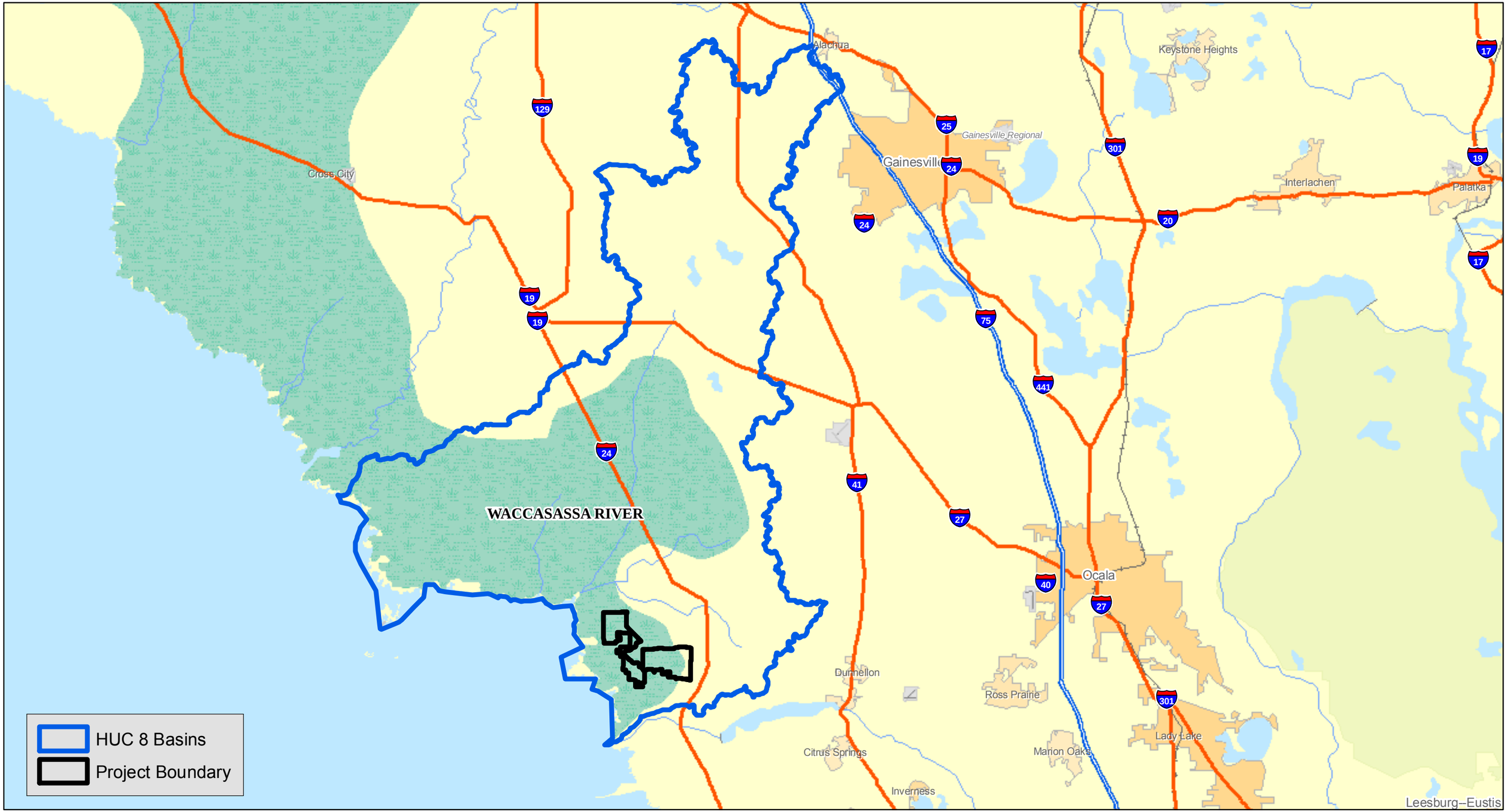

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Figure 3-1 - HUC 8 Basin Line

Tarmac King Road Limestone Mine
Levy County, Florida

Image:2007 IR

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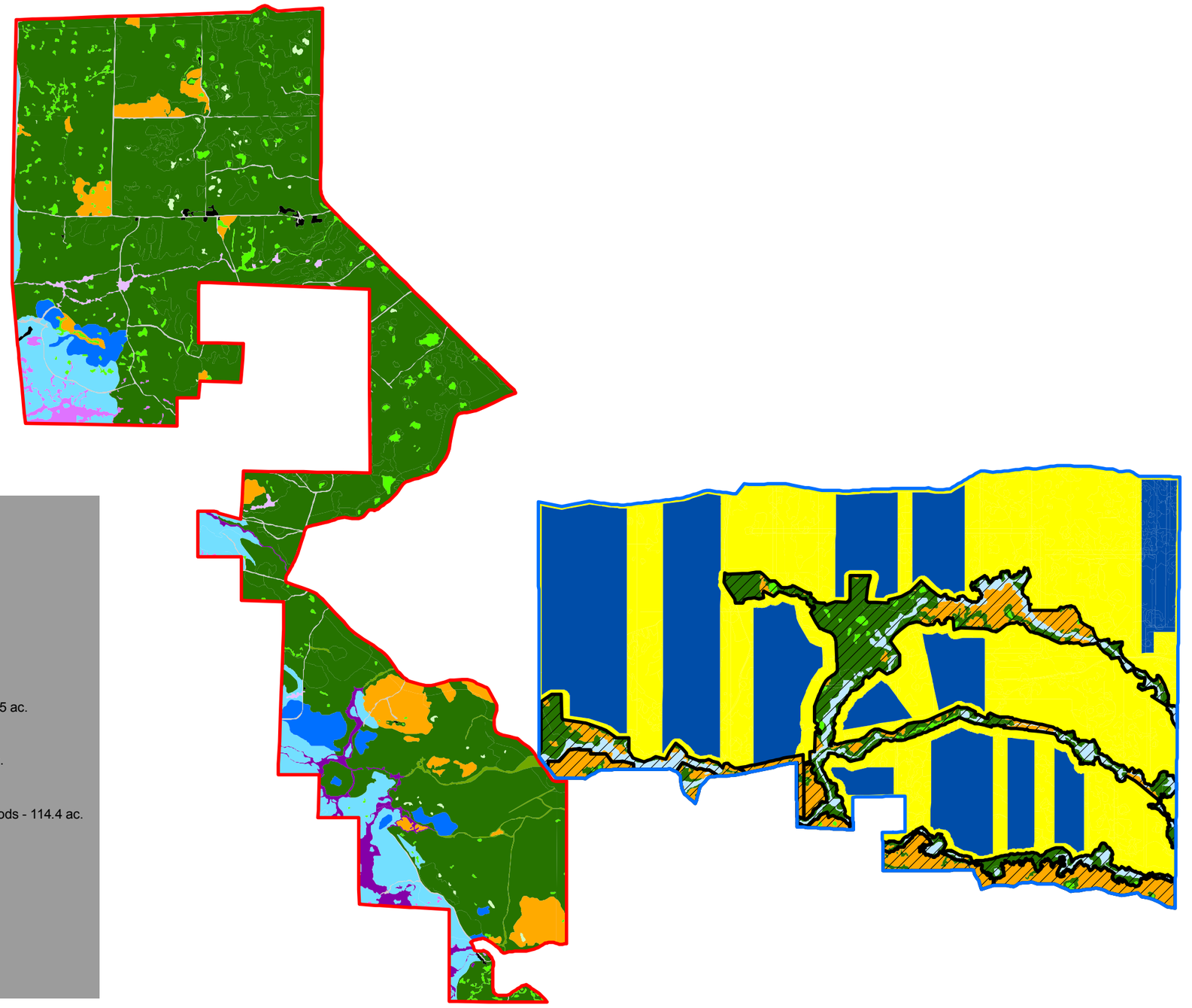

Figure 3-2
Mitigation Target Communities

Tarmac King Road Limestone Mine
Levy County, Florida

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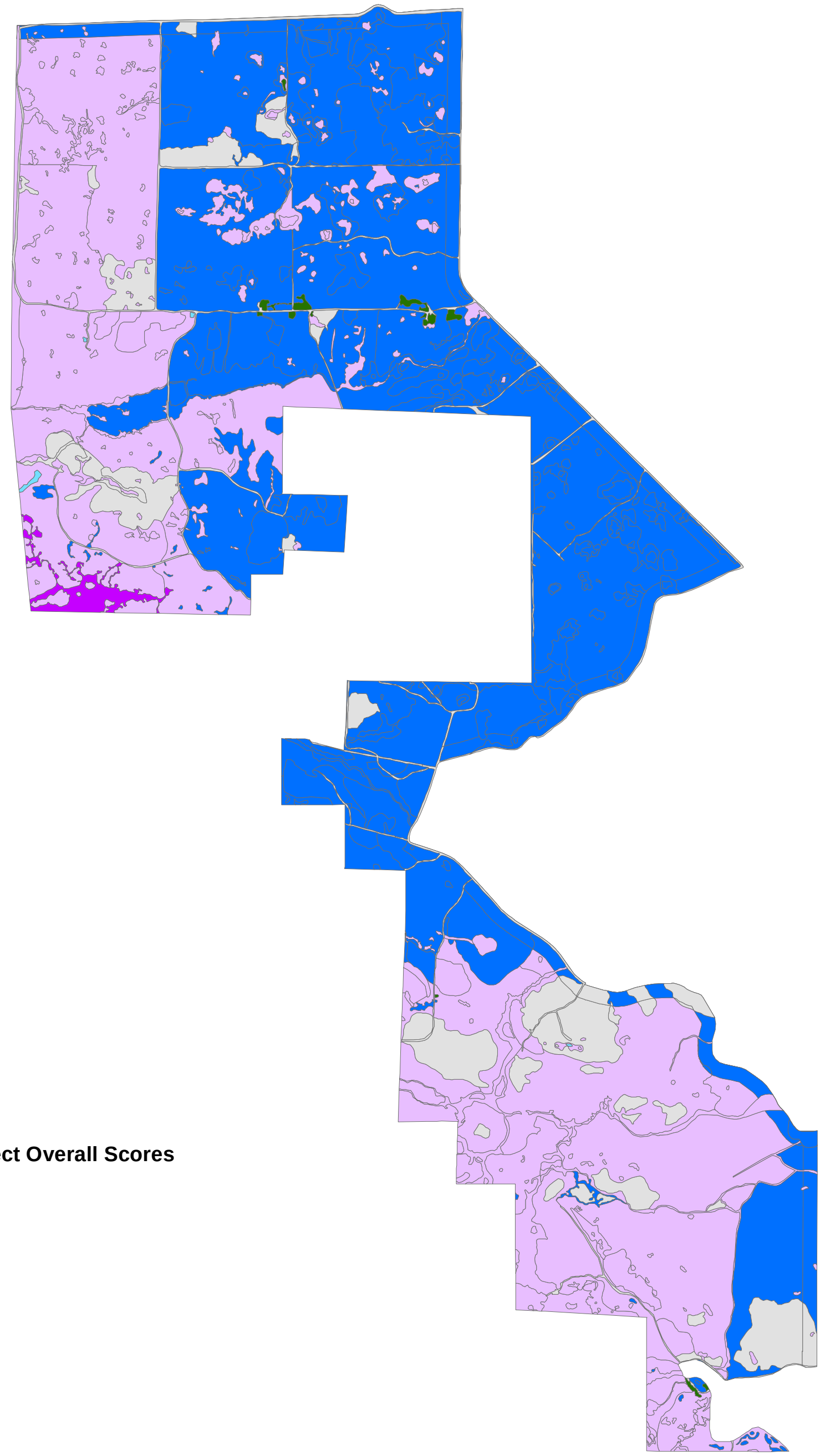

With Project Overall Scores

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

0 2,250 4,500 Feet

0 575 1,150 Meters

Figure 5-1
With Project Overall Score

Tarmac King Road Limestone Mine
Mitigation Parcel
Levy County, Florida

Image:None

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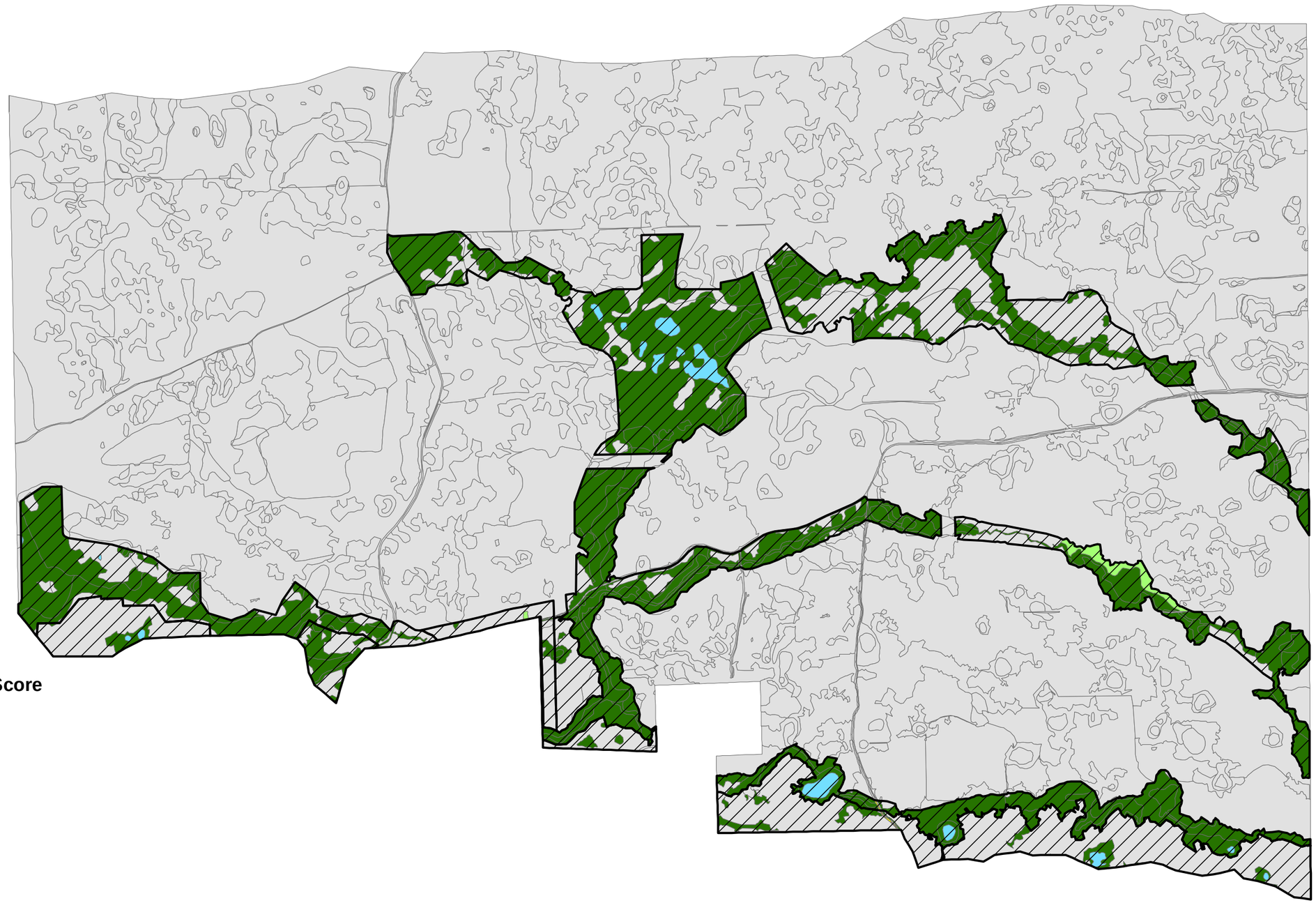

0 1,600 3,200 Feet

0 370 740 Meters

Figure 5-2
With Project Overall Score

Tarmac King Road Limestone Mine
Mine Parcel
Levy County, Florida

Image: None

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Mitigation Site Boundary

Release Year

1

15

30

0 2,250 4,500 Feet

0 575 1,150 Meters

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Figure 5-3
Release Year Map

Tarmac King Road Limestone Mine
Mitigation Parcel
Levy County, Florida

Image: None

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Coordinate System:
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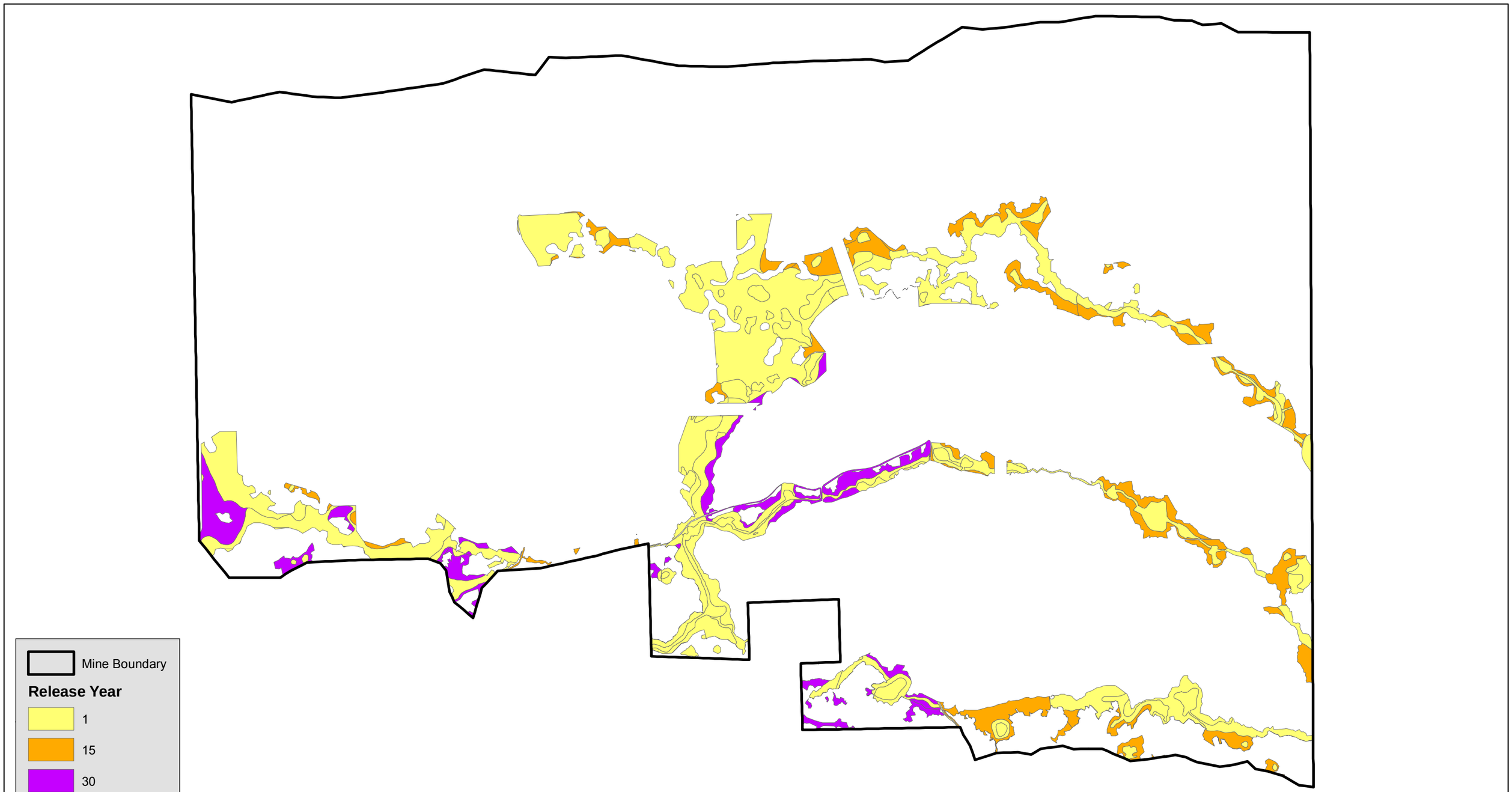

Figure 5-4
Release Year Map

Tarmac King Road Limestone Mine
Mine Parcel
Levy County, Florida

Image: None

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Coordinate System:
Florida Albers

Date: 05/23/2011 Rev. Date: n/a PM: MEE GIS Analyst: GdA Map Document: acoe_mine_release_yr_May2011_B_20110523_1_acw.mxd Project Number: 7856-001 PDF Document: acoe_mine_release_yr_May2011_B_20110523_1_acw.pdf Plot Size: 11 x 17

CONSERVATION EASEMENT

THIS CONSERVATION EASEMENT is made this _____ day of _____ 20____, by and among **Plum Creek Timberlands, L.P.**, a Delaware limited partnership doing business in Florida, having an address at One Concourse Parkway, Suite 755, Atlanta, GA 30328, (Grantor), **Tarmac America LLC**, a Delaware limited liability company doing business in Florida, having an address at 455 Fairway Drive, Deerfield Beach, Florida 33441 ("Permittee"), and the **State of Florida Department of Environmental Protection** (Grantee or Department), whose address is Department of Environmental Protection, Division of State Lands, 3900 Commonwealth Boulevard, Tallahassee, FL 32399-3000. As used herein, the term Grantor shall include any and all heirs, successors or assigns of the Grantor, and all subsequent owners of the Property (as hereinafter defined) and the terms Permittee and Grantee shall include any successors or assignees.

WITNESSETH

WHEREAS, the Grantor has entered into a mineral lease with Titan America LLC (Titan) to allow Permittee, a wholly owned subsidiary of Titan, to conduct limerock mining activities on approximately 4,750 acres (Mine Parcel), including certain jurisdictional wetlands and other surface waters in an area known as the Tarmac King Road Mine (Project) located in Levy County, Florida, as described in the Permit (hereinafter defined) which is subject to the regulatory jurisdiction of the Grantee under Part IV of Chapter 373 of the Florida Statutes;

WHEREAS, the Grantor is the owner of approximately 859 acres of unmined streams, associated floodplains and certain adjacent uplands of the Mine Parcel hereinafter referred to as the "Property", the location of which is shown in **Attachment 1**, attached hereto and incorporated herein by reference;

WHEREAS, Department Permit No. 244771-002 (Permit) and Department of the Army ("Corps") Permit No. [_____] ("Corps Permit") authorize Permittee to conduct certain activities which affect waters in or of the State of Florida and waters of the United States;

WHEREAS, Grantor has authorized Permittee to utilize the Property as mitigation for permitted impacts on the Mine Parcel;

WHEREAS, the Corps is not authorized to hold conservation easements, and the Department has agreed to hold the easement on behalf of the Corps; and

WHEREAS, pursuant to Section 373.414(1)(b), F.S., the Grantee agrees to accept this conservation easement and the Grantor agrees to grant this conservation easement as a condition of the Permit and the Corps Permit granted to Permittee to offset or prevent adverse impacts to water quality and natural resources, such as fish, wildlife, and wetland or other surface water functions. Specifically, this conservation easement is intended to:

Offset impacts to wetlands and other surface waters;
Prevent cumulative impacts;
Prevent secondary impacts to the functions provided to fish, wildlife, and listed species by wetlands, other surface waters, and uplands;
Protect a mitigation area.

NOW THEREFORE, in consideration of the above and the mutual covenants, terms, conditions and restrictions contained herein, together with other good and valuable consideration, the adequacy and receipt of which is hereby acknowledged, Grantor hereby voluntarily grants and conveys a perpetual conservation easement, as defined in Section 704.06, Florida Statutes, for and in favor of the Grantee upon the Property which shall run with the land and be binding upon the Grantor, and shall remain in full force and effect forever.

The scope, nature and character of this conservation easement shall be as follows:

1. **Purpose**. The purpose of this conservation easement is to retain land or water areas in their natural, vegetative, hydrologic, scenic, open, agricultural or wooded condition and to retain such areas as suitable habitat for fish, plants or wildlife. Those wetland or upland areas included in the conservation easement that are to be preserved, enhanced, restored or mitigated for pursuant to the Permit shall be retained and maintained in the enhanced or created condition required by the Permit.

2. **Grant of Easement**. Grantor hereby grants to Grantee a perpetual conservation easement on, over, across, under, and through the Property for the purposes set forth above and subject to the following terms and conditions.

3. **Rights of the Grantee**. To carry out this purpose, the following rights are conveyed to the Grantee by this conservation easement:

a. The right to take action to preserve and protect the environmental value of the Property;

b. The right to prevent any activity on or use of the Property that is inconsistent with the purpose of this conservation easement, and to require the restoration of areas or features of the Property that may be damaged by any inconsistent activity or use;

c. Upon reasonable notice, the right to enter upon and inspect the Property in a reasonable manner and at reasonable times, including the right to use vehicles and all necessary equipment to determine if Grantor or its successors and assigns are complying with the covenants and prohibitions contained in this conservation easement; and

d. The right to enforce this conservation easement by injunction or proceed at law or in equity to enforce the provisions of this conservation easement and the covenants set forth herein, to prevent the occurrence of any of the prohibited activities hereinafter

set forth, and the right to require Grantor to restore such areas or features of the Property that may be damaged by any inconsistent activity or use.

e. In the event that (i) after notice, either the Permittee or the Grantor fails to carry out the maintenance obligations required by Paragraphs 8 or 9 herein, or (ii) the Grantee elects to perform maintenance that is more extensive than that required of the Permittee or Grantor hereunder, or to perform enhancement, then the Grantee shall have the right to enter the Property to take any and all necessary and appropriate actions to implement or enhance the Property without thereby forfeiting any other rights or remedies provided to the Grantee herein. If the Grantee exercises its rights under part (ii) of this subparagraph, neither Grantor nor Permittee shall be liable for any costs or responsibilities associated with Grantee's actions.

4. **Prohibited Uses**. Except as otherwise expressly provided herein, any activity on or use of the Property inconsistent with the purpose of this conservation easement is prohibited. Without limiting the foregoing, the following activities and uses are expressly prohibited, except for restoration, creation, enhancement, maintenance, and monitoring activities conducted by Permittee authorized by the Permit.

a. Construction or placing of structures on, above, or below the ground, including but not limited to: buildings, roads, docks, piers, billboards or other advertising; utilities, or other structures, except as specifically provided in paragraph 5 herein;

b. Dumping or placing of soil or other substances as land fill, or dumping or placing of trash, solid or liquid waste, or unsightly materials, hazardous substances, toxic waste, or offensive materials;

c. Removal or destruction of native trees, shrubs, or other vegetation;

d. Planting or seeding of exotic or nuisance species or other plants that are outside their natural range or zone of dispersal and have, or are able to form, self-sustaining, expanding, and free-living populations in a natural community with which they have not previously associated;

e. Exploration for or extraction of oil or gas, and excavation, dredging, or removal of loam, peat, gravel, soil, rock, or other material substance in such manner as to affect the surface;

f. Surface use except for purposes that permit the land or water area to remain in its natural condition;

g. Activities detrimental to drainage, flood control, water conservation, erosion control, soil conservation, or fish and wildlife habitat preservation including, but not limited to, ditching, diking, dredging and fencing;

h. Acts or uses detrimental to such aforementioned retention and maintenance of land or water areas;

i. Acts or uses detrimental to the preservation of the structural integrity or physical appearance of sites, or properties of historical, architectural, archaeological, or cultural significance; and

j. The use of All-Terrain Vehicles (ATVs) off-road, other than those used for land management activities, is prohibited (ATVs are permitted on existing roads identified in the Baseline Documentation Report required by paragraph 24 herein).

5. **Reserved Rights**. Except as might interfere with Permittee's mining activities on the surrounding property, Grantor reserves to itself, its successors or assigns all rights as owner of the Property, including the right to engage in uses of the Property that are not prohibited herein and that are not inconsistent with any Department rules, criteria, permit and the intent and purposes of this conservation easement. Specifically, Grantor retains any and all rights, benefits, privileges and credits related to carbon sequestration in the timber and soil on the Property. The following uses are expressly declared to be consistent with the purposes of this conservation easement.

a. Controlled burning in accordance with Department of Agricultural and Consumer Services' fire management guidelines.

b. Machine clearing of fire lines and fire breaks as part of fire fighting, fire suppression, or controlled burns.

c. Installation and/or maintenance of fences for land management or habitat protection purposes.

d. Removal or extermination of nuisance, invasive or exotic plant or wildlife species.

e. ATVs and other motorized vehicles are permitted on existing roads as identified in the Baseline Condition Document required by paragraph 24 herein.

f. Hunting of white-tailed deer, wild turkey, quail, and feral hogs, other indigenous or non-native animal species in accordance with all state regulations and local ordinances.

g. Fishing and passive recreation, not to include the use of motorized boats or motorized vehicles or ATVs off-road, except that motorized vehicles and ATVs are permitted on existing roads identified in the Baseline Documentation Report required by paragraph 24 herein.

h. The right to relocate listed, threatened or endangered plant and wildlife species from offsite locations to appropriate areas within the Property.

i. Installation of signs for land management or for habitat protection purposes.

j. Sustainable harvesting of seeds, fruits, and flowers of native species.

k. The right to lease or license exclusive hunting and fishing privileges expressly subject to the terms and conditions of this conservation easement.

l. Except as otherwise required by the Permit, Grantor may maintain and use, but may not improve, existing roads, if any.

m. Except as otherwise required by the Permit, Grantor may maintain, replace as may be necessary, and/or use, but may not improve, existing culverts and drainage ditches or swales on the Property (unless and until Grantee notifies Grantor in writing of its intention to enhance any such areas pursuant to Paragraph 3(e)(ii) above).

n. ATVs and other motorized vehicles are permitted on existing roads identified in the Baseline Documentation Report required by paragraph 24 herein.

6. **Public Access**. No right of access by the general public to any portion of the Property is conveyed by this conservation easement.

7. **Responsibilities of Parties**.

a. Prior to the release of all reclaimed mine lands from the mitigation requirements of the Permit and the Corps Permit and the reclamation requirements of the associated conceptual reclamation plan ("Maintenance Responsibility Termination Date"), Permittee on behalf of itself and its successors or assigns hereby agrees to bear all costs and liabilities related to the operation, upkeep, or maintenance of the Property as set forth in paragraph 8 below.

b. Following the Maintenance Responsibility Termination Date, Grantor agrees to bear the costs and liabilities related to the operation, upkeep, and maintenance of the Property, as set forth in Paragraph 9.

c. Grantee and its successors or assigns shall have no responsibility for any costs or liabilities related to the operation, upkeep or maintenance of the Property except Grantee agrees to bear all costs and liabilities related to any maintenance or enhancement activities it chooses to undertake pursuant to Paragraph 3(e) (ii) herein.

d. Neither the provisions of this Paragraph nor the provisions of Paragraphs 8 and 9 shall be construed to alter or change the provisions of Paragraph 11. Nor is this Paragraph intended to limit Grantor's responsibilities as owner of the Property.

8. **Maintenance Obligations Before Mitigation and Reclamation Release**. Until the Maintenance Responsibility Termination Date, the Permittee at its own expense

specifically agrees to be responsible for maintaining the ecological conditions of the Property established in the Baseline Documentation Report.

Pursuant to the terms of this conservation easement and the easement management and maintenance requirements of the Corps Permit, the Permittee shall have the following specific maintenance obligations and responsibilities prior to the Maintenance Responsibility Termination Date:

a. Placement and maintenance of signs identifying the Property as preserved environmentally sensitive lands.

b. Placement and maintenance of any signs required by Paragraph 6 of this conservation easement.

c. Reasonable efforts to limit or control invasive exotic species such as Brazilian Pepper, Melaleuca, Japanese and Old World Climbing Fern, Skunk Vine, Tropical Soda Apple, Cogan Grass, Torpedo Grass, Air Potato, Lantana, Primrose Willow, and Kudzu, provided that in carrying out such efforts there is no material adverse ecological impact upon the Property. In no case shall invasive exotic species expand beyond the level of their presence as documented in the Baseline Documentation Report.

d. Removal of trash, waste or unsightly or offensive materials.

9. **Maintenance Obligations After Mitigation and Reclamation Release**. The Grantor shall have the following specific management and maintenance obligations and responsibilities pursuant to this conservation easement and the easement management and maintenance requirements of the Corps Permit following the Maintenance Responsibility Termination Date:

a. Maintenance of signs required by paragraph 8, above.

b. Removal of trash, waste, or unsightly or offensive materials.

10. **Taxes**. Grantor, its successors or assigns, shall pay before delinquency any and all taxes, assessments, fees, and charges of whatever description levied on or assessed by competent authority on the Property, and shall furnish the Grantee with satisfactory evidence of payment upon request.

11. **Liability**. Grantor, its successors or assigns, shall be responsible for any and all liability, loss, damage, expense, judgment, or claim (including a claim for attorney fees) arising out of any negligent or willful action or activity resulting from the Grantor's use and ownership of or activities on the Property or the use by or activities of Grantor's agents, guests, lessees, or invitees on the Property, and indemnifies and holds the Grantee and Permittee harmless from same. Permittee, its successors or assigns, shall be responsible for any and all liability, loss, damage, expense, judgment, or claim (including a claim for attorney fees) arising out of any negligent or willful action or activity

resulting from the Permittee's use of or activities on the Property or the use by or activities of Permittee's agents, guests, lessees, or invitees on the Property, and indemnifies and holds the Grantor and Grantee harmless from same. The Grantee shall be responsible for any and all liability, loss, damage, expense, judgment, or claim (including a claim for attorney fees) arising out of any negligent or willful action of the Grantee's staff, its officers, employees, guests, invitees, and agents, for which it is found legally liable. Nothing herein shall be construed as an indemnity or a waiver of sovereign immunity enjoyed by the Grantee, as provided in section 768.28, Florida Statutes, as amended from time to time, or any other law providing limitations on claims. The Corps shall be responsible for any and all liability, loss, damage, expense, judgment, or claim (including a claim for attorneys fees) arising out of any actions of the Corps' staff, its officers, employees, guests, invitees, and agents, constituting negligence or intentional tort under federal or state laws.

12. **Hazardous Waste**. Grantor covenants and represents that no hazardous substance or toxic waste is currently known to exist nor has been, to Grantor's knowledge, generated, treated, stored, used, disposed of, or deposited in or on the Property, and that there are not now any underground storage tanks located on the Property. Grantor further indemnifies the Grantee and the Corps for any and all liability arising from any subsequent placement or discovery of hazardous substance or toxic waste on the Property arising out of any negligent or willful action or activity resulting from the Grantor's use and ownership of or activities on the Property or the use by or activities of Grantor's agents, guests, lessees, or invitees on the Property, and indemnifies and holds the Grantee and the Corps harmless from same. In the event such material is discovered such that Grantor is liable as provided herein, Grantor shall be responsible for bringing the Property into compliance with all applicable, existing at the time of discovery, environmental laws regarding hazardous substances and toxic waste.

13. **Rights of the Corps**. The Corps shall have all the rights of the Grantee under this conservation easement to the extent authorized by federal law. If authorized by law, the Corps shall approve any modification, alteration, release, or revocation of this conservation easement, and shall review and approve as necessary any additional structures or activities that require approval by the Grantee. The Grantor shall provide the Corps (District Engineer) at least 60 days advance notice in writing before any action is taken to alter or revoke this conservation easement. Before taking any actions under this conservation easement, including enforcement, the Corps shall provide at least 60 days advance notice in writing to the Grantor, Permittee and the Grantee. If the Grantee objects to the Corps' proposed action as being contrary to state law, the Grantee's position shall control.

14. **Enforcement Discretion**. Enforcement of the terms, provisions and restrictions of this conservation easement shall be at the reasonable discretion of the Grantee and the Corps, and any forbearance on behalf of the Grantee or the Corps to exercise its rights hereunder in the event of any breach by Grantor or Permittee, shall not be deemed or construed to be a waiver of the Grantee's or the Corps' rights.

15. **Enforcement Costs**. In any action by Grantee, Grantee shall be entitled to recover its costs, expert witness fees, and the reasonable cost of restoring the land to the natural vegetative and hydrologic condition existing at the time of execution of the conservation easement or to the vegetative and hydrologic condition required by the aforementioned Permit. These remedies are in addition to any other remedy, fine or penalty which may be applicable under Chapters 373 and 403, Florida Statutes, or available at law or in equity.

16. **Assignment of Rights**. The Grantee agrees to hold this conservation easement exclusively for conservation purposes and that it will not assign its rights and obligations under this conservation easement except to another organization qualified to hold such interests under applicable state laws.

17. **Recording in Land Records**. Grantor agrees to record this Conservation easement and any amendments hereto in a timely fashion in the Official Records of Levy County, Florida. Grantor shall pay all recording costs and taxes necessary to record this conservation easement in the public records.

18. **Successors**. The covenants, terms, conditions and restrictions of this conservation easement shall be binding upon, and inure to the benefit of the parties hereto and their respective personal representatives, heirs, successors and assigns and shall continue as a servitude running in perpetuity with the Property.

19. **Notices**. All notices, consents, approvals or other communications hereunder shall be in writing and shall be deemed properly given if sent by United States certified mail, return receipt requested, addressed to the appropriate party or successor-in-interest.

20. **Subsequent Deeds**. Grantor shall insert the terms and restrictions of this conservation easement in any subsequent deed or other legal instrument by which Grantor divests itself of any interest in the Property. Grantor further agrees to give written notice to the Grantee of the transfer of any interest at least twenty days prior to the date of such transfer. The failure of Grantor to perform any act required by this paragraph shall not impair the validity of this conservation easement or limit its enforceability in any way.

21. **Severability**. If any provision of this conservation easement or the application thereof to any person or circumstances is found to be invalid, the remainder of the provisions of this conservation easement shall not be affected thereby, as long as the purpose of the Conservation easement is preserved.

22. **Alteration or Revocation**. This conservation easement may be amended, altered, released or revoked only by permit modification as necessary and written agreement between the parties hereto or their heirs, assigns or successors-in-interest, which shall be filed in the public records of Levy County.

23. **Controlling Law**. The interpretation and performance of this conservation easement shall be governed by the laws of the State of Florida.

24. **Baseline Documentation Report**. The specific conservation values of the Property are documented in the Baseline Documentation Report associated with this conservation easement. The Baseline Documentation Report consists of reports, maps, photographs, and other documentation that the parties agree provide, collectively, an accurate representation of the Property at the time of this grant, and which is intended to serve as an objective information baseline for monitoring compliance with the terms of this grant. The Baseline Documentation Report is maintained in the offices of the Florida Department of Environmental Protection, and is incorporated by this reference. A copy of the Baseline Documentation Report is available from the Department on request.

25. **Acts Beyond Grantor's Control**. Nothing contained in this conservation easement shall be construed to entitle Grantee to bring any action against Grantor for any injury to or change in the Property resulting from natural causes beyond Grantor's control, including, without limitation, fire, flood storm, and earth movement, or from any necessary action taken by Grantor under emergency conditions to prevent, abate or mitigate significant injury to the Property or to public health, safety or welfare resulting from such causes.

26. **Release.** If all or any part of the mining activities for which the Permit was obtained cannot or will not be accomplished for any reason, Grantor shall be entitled to a release or partial release of said conservation easement as it pertains to the corresponding part or parts of the Property , provided:

(i) No disturbance or site preparation has occurred in, on, or over specified wetlands or surface waters on the Mine Parcel in an amount approved by the Grantee and the Corps as commensurate with the part or parts of the Property for which release is being sought;

(ii) The Permittee has acknowledged that no permitted activities will occur in such identified wetlands or surface waters on the Mine Parcel; and,

(iii) The Grantor provides the Department with a legal description of the part or parts of the Property for which release is being sought; and

(iv) The Permittee has formally surrendered the Permit to the Department with respect to such wetlands and surface waters.

(v) Once the Permit is formally surrendered, the Department shall prepare, execute and deliver to Grantor a Release of conservation easement for the applicable part or parts of the Property in recordable form, which Grantor shall record, along with a legal description of the part or parts being released, at Grantor's cost in

the land records of Levy County. On recording, the conservation easement will no longer have force and effect over the part or parts of the Property described in subparagraph 26(c)(iii), above.

TO HAVE AND TO HOLD unto the Grantee forever. The covenants, terms, conditions, restrictions and purpose imposed with this conservation easement shall be binding upon Grantor and Grantee, and shall continue as a servitude running in perpetuity with the Property.

Grantor hereby covenants with said Grantee that Grantor is lawfully seized of said Property in fee simple; that the Property is free and clear of all encumbrances that are inconsistent with the terms of this conservation easement and all mortgages have been joined or subordinated; that Grantor has good right and lawful authority to convey this conservation easement.

IN WITNESS WHEREOF, the Grantor, Permittee and Grantee have executed this conservation easement on the day and year last below written.

("Grantor")

Signed, sealed and delivered
in our presence as witnesses:

Plum Creek Timberlands, L.P.
By: Plum Creek Timber I, L.L.C.,
its General Partner

_____
Signature of Witness #1

By: _____
[NAME]

_____
Printed/Typed Name Witness #1

Title: [TITLE]

_____
Signature of Witness #2

_____
Printed/Typed Name Witness #2

STATE OF GEORGIA
COUNTY OF FULTON

The foregoing instrument was acknowledged before me this ___ day of _____, 20___, by _____, as _____of Plum Creek Timber I, L.L.C., general partner of Plum Creek Timberlands, L.P., **a Delaware limited partnership**, on behalf of said partnership. [__] He is personally known to me or [__] has produced _____ as identification.

(SEAL)

_____
Notary Public Signature

_____
Printed/Typed Name of Notary

Commission No. _____
Commission Expires _____

("Permittee")

Signed, sealed and delivered
in our presence as witnesses:

Tarmac America, L.L.C.

_____
Signature of Witness #1

By: _____
Albert Townsend

_____
Printed/Typed Name Witness #1

Title: Director of Real Estate
and Environmental Services

_____
Signature of Witness #2

_____
Printed/Typed Name Witness #2

STATE OF FLORIDA
COUNTY OF _____

The foregoing instrument was acknowledged before me this ___ day of _____, 20___, by _____, as _____of Tarmac America, L.L.C., **a Delaware limited liability company**, on behalf of said company. [__] He is personally known to me or [__] has produced _____ as identification.

(SEAL)

_____
Notary Public Signature

_____
Printed/Typed Name of Notary

Commission No. _____
Commission Expires _____

("Grantee")

Signed, sealed and delivered
in our presence as witnesses:

State of Florida, Department of Environmental Protection

_____
Signature of Witness #1

By: _____
Printed Name:

_____
Printed/Typed Name Witness #1

As its: Deputy Director, Division of Water Resource Management

_____
Signature of Witness #2

_____
Printed/Typed Name Witness #2

STATE OF FLORIDA
COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____, 20___, by _____ as Deputy Director of the Division of Water Resource Management of the State of Florida, Department of Environmental Protection. [__] He is personally known to me or [__] has produced _____ as identification.
(SEAL)

_____
Notary Public Signature

_____
Printed/Typed Name of Notary

Commission No. _____
Commission Expires _____

Attachment 1

Tarmac King Road Mine Parcel Pending Final Survey

CONSERVATION EASEMENT

THIS CONSERVATION EASEMENT is given this _____ day of _____ 20____, by **Tarmac America LLC, a Delaware limited liability company doing business in Florida**, having an address at 455 Fairway Drive, Deerfield Beach, FL 33441, (Grantor) to the **State of Florida Department of Environmental Protection** (Grantee or Department), whose address is Department of Environmental Protection, Division of State Lands, 2051 East Dirac Drive, Tallahassee, FL 32310. As used herein, the term Grantor shall include any and all heirs, successors or assigns of the Grantor, and all subsequent owners of the Property (as hereinafter defined) and the term Grantee shall include any successor or assignee of the Grantee.

WITNESSETH

WHEREAS, the Grantor desires to conduct limerock mining activities on approximately 4,750 acres, including certain jurisdictional wetlands and other surface waters in an area known as the "Mine Parcel" of the Tarmac King Road Mine (Project) located in Levy County, Florida, as described in the Permit (hereinafter defined) which is subject to the regulatory jurisdiction of the Grantee under Part IV of Chapter 373 of the Florida Statutes;

WHEREAS, the Grantor proposes to place approximately 4,526 acres of unmined forested and herbaceous wetland and uplands of the Mitigation Parcel (Property) under a conservation easement, the location of which is shown in **Attachment 1**, attached hereto and incorporated herein by reference;

WHEREAS, the Grantor is the owner of the Property more specifically described in Attachment 1 hereto;

WHEREAS, Department Permit No. 244771-002 (Permit) and Department of the Army ("Corps") Permit No. [_____] ("Corps Permit") authorize certain activities which affect waters in or of the State of Florida and waters of the United States;

WHEREAS, this Permit requires that the Grantor preserve, enhance, restore or mitigate for impacts to wetlands, other surface waters, or uplands under the Department's jurisdiction;

WHEREAS, the Corps is not authorized to hold conservation easements, and the Department has agreed to hold the easement on behalf of the Corps; and

WHEREAS, pursuant to Section 373.414(1)(b), F.S., the Grantee agrees to accept this conservation easement and the Grantor agrees to grant this conservation easement as a condition of the Permit and the Corps Permit to offset or prevent adverse impacts to water quality and natural resources, such as fish, wildlife, and wetland or other surface water functions. Specifically, this conservation easement is intended to:

Offset impacts to wetlands and other surface waters;
Prevent cumulative impacts;
Prevent secondary impacts to the functions provided to fish, wildlife, and listed species by wetlands, other surface waters, and uplands;
Protect a mitigation area.

NOW THEREFORE, in consideration of the above and the mutual covenants, terms, conditions and restrictions contained herein, together with other good and valuable consideration, the adequacy and receipt of which is hereby acknowledged, Grantor hereby voluntarily grants and conveys a perpetual conservation easement, as defined in Section 704.06, Florida Statutes, for and in favor of the Grantee upon the Property which shall run with the land and be binding upon the Grantor, and shall remain in full force and effect forever.

The scope, nature and character of this conservation easement shall be as follows:

1. **Purpose**. The purpose of this conservation easement is to retain land or water areas in their natural, vegetative, hydrologic, scenic, open, agricultural or wooded condition and to retain such areas as suitable habitat for fish, plants or wildlife. Those wetland or upland areas included in the conservation easement that are to be preserved, enhanced, restored or mitigated for pursuant to the Permit shall be retained and maintained in the condition required by the Permit.

2. **Grant of Easement**. Grantor hereby grants to Grantee a perpetual conservation easement on, over, across, under, and through the Property.

3. **Rights of the Grantee**. To carry out this purpose, the following rights are conveyed to the Grantee by this conservation easement:

a. The right to take action to preserve and protect the environmental value of the Property;

b. The right to prevent any activity on or use of the Property that is inconsistent with the purpose of this conservation easement, and to require the restoration of areas or features of the Property that may be damaged by any inconsistent activity or use;

c. Upon reasonable notice, the right to enter upon and inspect the Property in a reasonable manner and at reasonable times, including the right to use vehicles and all necessary equipment to determine if Grantor or its successors and assigns are complying with the covenants and prohibitions contained in this conservation easement; and

d. The right to enforce this conservation easement by injunction or proceed at law or in equity to enforce the provisions of this conservation easement and the covenants set forth herein, to prevent the occurrence of any of the prohibited activities hereinafter set forth, and the right to require Grantor to restore such areas or features of the Property that may be damaged by any inconsistent activity or use.

e. In the event that (i) after notice, the Grantor fails to carry out the maintenance obligations required by Paragraphs 8 or 9 herein, or (ii) the Grantee elects to perform maintenance that is more extensive than that required of the Grantor hereunder, or to perform enhancement, then the Grantee shall have the right to enter the Property to take any and all necessary and appropriate actions to implement or enhance the Property without thereby forfeiting any other rights or remedies provided to the Grantee herein. If the Grantee exercises its rights under part (ii) of this subparagraph, Grantor shall not be liable for any costs or responsibilities associated with Grantee's actions.

4. **Prohibited Uses**. Except as otherwise expressly provided herein, any activity on or use of the Property inconsistent with the purpose of this conservation easement is prohibited. Without limiting the foregoing, the following activities and uses are expressly prohibited, except for restoration, creation, enhancement, maintenance, and monitoring activities authorized by the Permit.

a. Construction or placing of structures on, above, or below the ground, including but not limited to: buildings, roads, docks, piers, billboards or other advertising; utilities, or other structures, except as specifically provided in paragraph 5 herein;

b. Dumping or placing of soil or other substances as land fill, or dumping or placing of trash, solid or liquid waste, or unsightly materials, hazardous substances, toxic waste, or offensive materials;

c. Removal or destruction of native trees, shrubs, or other vegetation;

d. Planting or seeding of exotic or nuisance species or other plants that are outside their natural range or zone of dispersal and have, or are able to form, self-sustaining, expanding, and free-living populations in a natural community with which they have not previously associated;

e. Exploration for or extraction of oil or gas, and excavation, dredging, or removal of loam, peat, gravel, soil, rock, or other material substance in such manner as to affect the surface;

f. Surface use except for purposes that permit the land or water area to remain in its natural condition;

g. Activities detrimental to drainage, flood control, water conservation, erosion control, soil conservation, or fish and wildlife habitat preservation including, but not limited to, ditching, diking, dredging and fencing;

h. Acts or uses detrimental to such aforementioned retention and maintenance of land or water areas;

i. Acts or uses detrimental to the preservation of the structural integrity or physical appearance of sites, or properties of historical, architectural, archaeological, or cultural significance; and

j. The use of All-Terrain Vehicles (ATVs) off-road, other than those used for land management activities, is prohibited. (ATVs are permitted on existing roads identified in the Baseline Documentation Report required by paragraph 24 herein).

5. **Reserved Rights**. Grantor reserves to itself, its successors or assigns all rights as owner of the Property, including the right to engage in uses of the Property that are not prohibited herein and that are not inconsistent with any Department rules, criteria, permit and the intent and purposes of this conservation easement. Specifically, Grantor retains all rights, benefits, privileges and credits related to carbon sequestration in the timber and soil on the Property. The following resource-based recreational uses are expressly declared to be not inconsistent with the purposes of this conservation easement.

a. Controlled burning in accordance with Department of Agricultural and Consumer Services' fire management guidelines.

b. Machine clearing of fire lines and fire breaks as part of fire fighting, fire suppression, or controlled burns.

c. Installation and/or maintenance of fences for land management or habitat protection purposes.

d. Removal or extermination of nuisance, invasive or exotic plant or wildlife species.

e. ATVs and other motorized vehicles are permitted on existing roads as identified in the Baseline Documentation Report required by paragraph 24 herein.

f. Hunting of white-tailed deer, wild turkey, quail, feral hogs, and other indigenous or non-native animal species in accordance with all state regulations and local ordinances.

g. Fishing and passive recreation, not to include the use of motorized boats or motorized vehicles or ATVs, except on existing roads.

h. The right to relocate listed, threatened or endangered plant and wildlife species from offsite locations to appropriate areas within the Property.

i. Installation of signs for land management or for habitat protection purposes.

j. Sustainable harvesting of seeds, fruits, and flowers of native species.

k. Sustainable thinning or selective harvesting of pine trees, provided these activities are conducted utilizing applicable best management practices which minimize adverse impacts to wetlands and other surface waters on the Property to the greatest extent practicable.

l. Except as otherwise required by the Permit, Grantor may maintain and use, but may not improve, existing roads, if any.

m. Except as otherwise required by the Permit, Grantor may maintain and use existing ponds, culverts, and drainage ditches or swales on the Property (unless and until Grantee notifies Grantor in writing of its intention to enhance any such areas pursuant to Paragraph 3(e)(ii) above).

n. Limited land clearing as authorized in writing by the Grantee for the purpose of constructing, operating, or maintaining amenities such as pile-supported boardwalks; un-mulched and unpaved recreational trails; informational and directional signs; and containers for litter disposal. These activities shall be subject to the following conditions:

(1) Grantor shall minimize and avoid, to the fullest extent possible, impact to any wetland or upland buffer areas within the conservation easement area and shall avoid materially diverting the direction of the natural surface water flow in such area;

(2) Such facilities and improvements shall be constructed and maintained to be aesthetically pleasing and not contrary to the purposes of this conservation easement;

(3) This conservation easement shall not constitute permit authorization for the construction and operation of the resource based recreational facilities. Any such work shall be subject to all applicable federal, state, regional or local permitting requirements.

o. The right to lease or license exclusive hunting and fishing privileges expressly subject to the terms and conditions of this conservation easement.

6. **Public Access**. No right of access by the general public to any portion of the Property is conveyed by this conservation easement.

7. **Responsibilities of Parties**.

a. Prior to the release of all reclaimed mine lands from the mitigation requirements of the Permit and the Corps Permit and the reclamation requirements of the associated conceptual reclamation plan ("Maintenance Responsibility Termination Date"), Grantor on behalf of itself and its successors or assigns hereby agrees to bear all costs and liabilities related to the operation, upkeep, or maintenance of the Property as set forth in paragraph 8 below.

b. Following the Maintenance Responsibility Termination Date, Grantor agrees to bear the costs and liabilities related to the operation, upkeep, and maintenance of the Property, as set forth in Paragraph 9.

c. Grantee and its successors or assigns shall have no responsibility for any costs or liabilities related to the operation, upkeep or maintenance of the Property except Grantee agrees to bear all costs and liabilities related to any maintenance or enhancement activities it chooses to undertake pursuant to Paragraph 3(e)(ii) herein.

d. Neither the provisions of this Paragraph nor the provisions of Paragraphs 8 and 9 shall be construed to alter or change the provisions of Paragraph 11. Nor is this Paragraph intended to limit Grantor's responsibilities as owner of the Property.

8. **Maintenance Obligations Before Mitigation and Reclamation Release**. Without intending to limit Grantor's responsibilities as owner of the Property, until the Maintenance Responsibility Termination Date, the Grantor at its own expense specifically agrees to be responsible for maintaining the ecological conditions of the Property established in the Baseline Documentation Report and supervising tenants to ensure compliance with the provisions of this conservation easement.

Pursuant to the terms of this conservation easement and in satisfaction of Paragraph __ of the Permit and the easement management and maintenance requirements of the Corps Permit, the Grantor shall have the following specific maintenance obligations and responsibilities prior to the Maintenance Responsibility Termination Date:

a. Placement and maintenance of signs identifying the Property as preserved environmentally sensitive lands.

b. Reasonable efforts to limit or control invasive exotic species such as Brazilian Pepper, Melaleuca, Japanese and Old World Climbing Fern, Skunk Vine, Tropical Soda Apple, Cogan Grass, Torpedo Grass, Air Potato, Lantana, Primrose Willow, and Kudzu, provided that in carrying out such efforts there is no material adverse ecological impact upon the Property. In no case shall invasive exotic species expand beyond the level of their presence as documented in the Baseline Documentation Report.

c. Removal of trash, waste or unsightly or offensive materials.

9. **Maintenance Obligations After Mitigation and Reclamation Release**. Without intending to limit Grantor's responsibilities as owner of the Property, the Grantor shall have the following specific management and maintenance obligations and responsibilities pursuant to this conservation easement and in satisfaction of Paragraph __ of the Permit and the easement management and maintenance requirements of the Corps Permit following the Maintenance Responsibility Termination Date:

a. Maintenance of signs required by paragraph 8, above.

b. Removal of trash, waste, or unsightly or offensive materials.

10. **Taxes**. Grantor, its successors or assigns, shall pay before delinquency any and all taxes, assessments, fees, and charges of whatever description levied on or assessed by competent authority on the Property, and shall furnish the Grantee with satisfactory evidence of payment upon request.

11. **Liability**. Grantor, its successors or assigns, shall be responsible for any and all liability, loss, damage, expense, judgment, or claim (including a claim for attorney fees) arising out of any negligent or willful action or activity resulting from the Grantor's use and ownership of or activities on the Property or the use by or activities of Grantor's agents, guests, lessees, or invitees on the Property, and indemnifies and holds the Grantee harmless from same. The Grantee shall be responsible for any and all liability, loss, damage, expense, judgment, or claim (including a claim for attorney fees) arising out of any negligent or willful action of the Grantee's staff, its officers, employees, guests, invitees, and agents, for which it is found legally liable. Nothing herein shall be construed as an indemnity or a waiver of sovereign immunity enjoyed by the Grantee, as provided in section 768.28, Florida Statutes, as amended from time to time, or any other law providing limitations on claims. Nothing herein shall be construed as an indemnity or a waiver of sovereign immunity enjoyed by the Grantee, as provided in section 768.28, Florida Statutes, as amended from time to time, or any other law providing limitations on claims. The Corps shall be responsible for any and all liability, loss, damage, expense, judgment, or claim (including a claim for attorneys fees) arising out of any actions of the Corps' staff, its officers, employees, guests, invitees and agents constituting negligence or intentional tort under federal or state laws.

12. **Hazardous Waste**. Grantor covenants and represents that no hazardous or toxic waste is currently known to exist nor has been, to Grantor's knowledge, generated, treated, stored, used, disposed of, or deposited in or on the Property, and that there are not now any underground storage tanks located on the Property. Grantor further indemnifies the Grantee and the Corps for any and all liability arising from any subsequent placement or discovery of hazardous or toxic waste on the Property arising out of any negligent or willful action or activity resulting from the Grantor's use and ownership of or activities on the Property or the use by or activities of Grantor's agents, guests, lessees, or invitees on the Property, and indemnifies and holds the Grantee and the Corps harmless from same. In the event such material is discovered such that Grantor is liable as provided herein, Grantor shall be responsible for bringing the Property into compliance with all applicable, existing at the time of discovery, environmental laws regarding hazardous or toxic waste.

13. **Rights of the Corps**. The Corps shall have all the rights and duties of the Grantee under this conservation easement to the extent authorized by federal law. If authorized by law, the Corps shall approve any modification, alteration, release, or revocation of this conservation easement, and shall review and approve as necessary any additional structures or activities that require approval by the Grantee. The Grantor shall provide the Corps (District Engineer) at least 60 days advance notice in writing before

any action is taken to alter or revoke this conservation easement. Before taking any actions under this conservation easement, including enforcement, the Corps shall provide at least 60 days advance notice in writing to the Grantor and Grantee. If the Grantee objects to the Corps' proposed action as being contrary to state law, the Grantee's position shall control.

14. **Enforcement Discretion**. Enforcement of the terms, provisions and restrictions of this conservation easement shall be at the reasonable discretion of the Grantee and the Corps, and any forbearance on behalf of the Grantee or the Corps to exercise its rights hereunder in the event of any breach by Grantor, shall not be deemed or construed to be a waiver of the Grantee's or the Corps' rights.

15. **Enforcement Costs**. In any action boy Grantee, Grantee shall be entitled to recover its costs, expert witness fees, and the reasonable cost of restoring the land to the natural vegetative and hydrologic condition existing at the time of execution of the conservation easement or to the vegetative and hydrologic condition required by the aforementioned Permit. These remedies are in addition to any other remedy, fine or penalty which may be applicable under Chapters 373 and 403, Florida Statutes, available at law or in equity.

16. **Assignment of Rights**. The Grantee agrees to hold this conservation easement exclusively for conservation purposes and that it will not assign its rights and obligations under this conservation easement except to another governmental organization qualified to hold such interests under applicable state and federal laws who agrees to hold the easement exclusively for conservation purposes.

17. **Recording in Land Records**. Grantor agrees to record this conservation easement and any amendments hereto in a timely fashion in the Official Records of Levy County, Florida. Grantor shall pay all recording costs and taxes necessary to record this conservation easement in the public records.

18. **Successors**. The covenants, terms, conditions and restrictions of this conservation easement shall be binding upon, and inure to the benefit of the parties hereto and their respective personal representatives, heirs, successors and assigns and shall continue as a servitude running in perpetuity with the Property.

19. **Notices**. All notices, consents, approvals or other communications hereunder shall be in writing and shall be deemed properly given if sent by United States certified mail, return receipt requested, addressed to the appropriate party or successor-in-interest.

20. **Subsequent Deeds**. Grantor shall insert the terms and restrictions of this conservation easement in any subsequent deed or other legal instrument by which Grantor divests itself of any interest in the Property. Grantor further agrees to give written notice to the Grantee of the transfer of any interest at least twenty days prior to the date of such transfer. The failure of Grantor to perform any act required by this paragraph shall not impair the validity of this conservation easement or limit its enforceability in any way.

21. **Severability**. If any provision of this conservation easement or the application thereof to any person or circumstances is found to be invalid, the remainder of the provisions of this conservation easement shall not be affected thereby, as long as the purpose of the conservation easement is preserved.

22. **Alteration or Revocation**. This conservation easement may be amended, altered, released or revoked only by permit modification as necessary and written agreement between the parties hereto or their heirs, assigns or successors-in-interest, which shall be filed in the public records of Levy County.

23. **Controlling Law**. The interpretation and performance of this conservation easement shall be governed by the laws of the State of Florida.

24. **Baseline Documentation Report**. The specific conservation values of the Property are documented in the Baseline Documentation Report associated with this conservation easement. The Baseline Documentation Report consists of reports, maps, photographs, and other documentation that the parties agree provide, collectively, an accurate representation of the Property at the time of this grant, and which is intended to serve as an objective information baseline for monitoring compliance with the terms of this grant. The Baseline Documentation Report is maintained in the offices of the Florida Department of Environmental Protection, and is incorporated by this reference. A copy of the Baseline Documentation Report is available from the Department on request.

25. **Acts Beyond Grantor's Control**. Nothing contained in this conservation easement shall be construed to entitle Grantee to bring any action against Grantor for any injury to or change in the Property resulting from natural causes beyond Grantor's control, including, without limitation, fire, flood storm, and earth movement, or from any necessary action taken by Grantor under emergency conditions to prevent, abate or mitigate significant injury to the Property or to public health, safety or welfare resulting from such causes.

26. **Release.** If all or any part of the mining activities for which the Permit was obtained cannot or will not be accomplished for any reason, Grantor shall be entitled to a release or partial release of said conservation easement as it pertains to the corresponding part or parts of the Property, provided:

(i) No disturbance or site preparation has occurred in, on, or over specified wetlands or surface waters on the Mine Parcel in an amount approved by the Grantee and the Corps as commensurate with the part or parts of the Property for which release is being sought;

(ii) The Permittee has acknowledged that no permitted activities will occur in such identified wetlands or surface waters on the Mine Parcel;

(iii) The Grantor provides the Department with a legal description of the part or parts of the Easement Lands for which release is being sought;

(iv) The Permittee has formally surrendered the Permit to the Department with respect to such wetlands and surface waters on the Mine Parcel; and

(v) Once the Permit is formally surrendered, the Department shall prepare, execute and deliver to Grantor in recordable form a Release of Conservation Easement for the part or parts of the Property, which Grantor shall record, along with a legal description of the part or parts being released, at Grantor's cost in the land records of Levy County. On recording, the conservation easement will no longer have force and effect over the part or parts of the Property described in subparagraph 26(c)(iii), above.

27. **Transfer of Title of Property to State of Florida, Board of Trustees, of the Internal Improvement Trust Fund.**

(a) **Offer of Transfer.** After all mitigation activities required by the Permit and the Corps Permit have been completed and released, the Permittee shall offer to transfer fee title to the Property to the Board of Trustees of the Internal Improvement Trust Fund of the State of Florida (the "Board of Trustees"). The Board of Trustees may choose to accept or refuse to accept the proposed transfer of fee title of the Mitigation Parcel to the Board of Trustees.

(b) **Extinguishment of Easement.** If the Board of Trustees chooses to accept the proposed transfer of fee title, then this conservation easement shall be extinguished by conveyance of fee title from the permittee to the Board of Trustees. If the Board of Trustees chooses to refuse to accept the proposed transfer of fee title, then this conservation easement shall remain perpetual, and no transfer shall occur.

(c) **Perpetual Preservation.** Any instrument transferring title to the Board of Trustees shall require the Board to accept the land as conservation lands pursuant to Chapter 259, Florida Statutes.

(d) **Management of Property** A proposed management plan for the Property that is consistent with Chapter 259, Florida Statutes, and section 253.032, F.S., shall be submitted to the Grantee and Board for approval within one (1) year of transfer, consistent with Section 253.032, F.S.

TO HAVE AND TO HOLD unto the Grantee forever. The covenants, terms, conditions, restrictions and purpose imposed with this conservation easement shall be binding upon Grantor and Grantee, and shall continue as a servitude running in perpetuity with the Property.

Grantor hereby covenants with said Grantee that Grantor is lawfully seized of said Property in fee simple; that the Property is free and clear of all encumbrances that are inconsistent with the terms of this conservation easement and all mortgages have been joined or subordinated; that Grantor has good right and lawful authority to convey this conservation easement; and that it hereby fully warrants and defends the title to the conservation easement hereby conveyed against the lawful claims of all persons whomsoever.

IN WITNESS WHEREOF, the Grantor and Grantee have executed this Conservation Easement on the day and year last below written.

("Grantor")

Signed, sealed and delivered
in our presence as witnesses:

Tarmac America LLC

_____
Signature of Witness

By: _____
Albert Townsend

_____
Printed/Typed Name

Title: Director of Real Estate and
Environmental Services

_____
Signature of Witness

_____
Printed/Typed Name

STATE OF FLORIDA
COUNTY OF _____

The foregoing instrument was acknowledged before me this ___ day of _____, 20___, by Albert Townsend, as Director of Real Estate and Environmental Services of Tarmac America, LLC, **a Delaware limited liability company**, on behalf of said company. [__] He is personally known to me or [__] has produced _____ as identification.

(SEAL)

_____
Notary Public Signature

_____
Printed/Typed Name of Notary

Commission No. _____
Commission Expires _____

("Grantee")

Signed, sealed and delivered
In our presence as witnesses:

State of Florida, Department of Environmental Protection

By: _____
Printed Name: Richard W. Cantrell

_____
Signature of Witness #1

_____
Printed/Typed Name Witness #1

As its: Deputy Director, Division of Water Resource Management

_____
Signature of Witness #2

_____
Printed/Typed Name Witness #2

STATE OF FLORIDA
COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____, 20___, by _____ as Deputy Director of the Division of Water Resource Management of the State of Florida, Department of Environmental Protection. [__] He is personally known to me or [__] has produced _____ as identification.

(SEAL)

_____
Notary Public Signature

_____
Printed/Typed Name of Notary

Commission No. _____
Commission Expires _____

Attachment 1

Tarmac King Road Mitigation Parcel Pending Final Survey

VEGETATIVE COVER EVALUATION
FOR REFERENCE AND ENHANCEMENT AREAS

04/18/2008

Prepared for:

Tarmac
A Titan America Business

Mr. Albert W. Townsend
TARMAC AMERICA, LLC
455 Fairway Drive
Deerfield Beach, FL 33441

Prepared by:

Biological Research Associates
Environmental Consultants
A Division of ENTRIX, Inc.

Shirley R. Denton, Ph.D., C.E.P.
Senior Project Scientist/ Vice President

McLane E. Evans, PMP
Senior Ecologist

1. Introduction

The Tarmac King Road Limestone Mine (TKRLM) project includes substantial opportunities for upland and wetland preservation and enhancement to mitigate for proposed impacts to wetlands due to limerock mining. The existing vegetative conditions on the site range from minimally disturbed natural forests to pine plantation in various stages of development to totally clearcut.

To assist in determining the natural condition of plant communities on the site, Biological Research Associates (BRA) has conducted an in-depth assessment of the major natural and silvicultural areas on the site. This assessment was conducted with the following goals in mind:

- Provide a baseline for mitigation planning by establishing a target for enhancement and restoration efforts.
- Demonstrate the existing condition of "uplands" on the mine site to facilitate avoidance planning and assist with designing mitigation that will be adequate to compensate for losses due to mining.
- Provide objective, support for the UMAM analyses
- Provide support for the COE permit and EIS submittals by identifying relative condition and species composition of potentially impacted areas.
- Assist in developing a mine plan to minimize impacts to the most valuable natural resources including rare plant species and biodiversity.
- Assist with the ERP, COE permit, and EIS by assisting the project team in avoiding impacts to the most valuable wetlands.
- Assist with the ERP by showing successional trends and determining where the mitigation can be expected to be successful without broad-scale enhancement plantings and where and what supplemental plantings may be needed.
- Quantify the quality of existing wildlife habitat across the site.
- Provide quantitative site data, hence reducing the potential that descriptive sampling on the site might be biased.

1.1. General Site Conditions

1.1.1. Location

The Tarmac King Road Mine Project is a 9,400+- acre site located in Sections 2, 3, 6-23, 29, and 30 of Township 16S, Range 16E; Section 31, Township 15S, Range 16E; Sections 1, 2, 12, 13 Township 16S, Range 15E and Sections 25, 26, 35, and 36 of Township 15S, Range 15E of Levy County, Florida. It is located approximately one mile west of US 19 and two miles north of SR 40 (see Map 1). The western portion of the site includes portions of Waccasassa Bay and abuts state-owned lands. Plum Creek Timberlands border the north, a portion of the south and a portion of the west sides of the site. The remainder of the west side is bordered by Waccasassa Bay Preserve, and the remainder of the south side is bordered by a rural residential parcel and the

Gulf Rock Limerock Mine. The east side of the site is bordered by a seventy- foot-wide Progress Energy powerline easement (see Map 2). The proposed mine site is unique in that it is one of the few sites where the Avon Park limestone formation (the oldest and hardest limestone formation in Florida) approaches the surface in areas large enough to make it technically feasible to be mined as aggregate.

1.1.2. Hydrology

Overall elevation on the TKRM decreases from east to west, and sheet flow is generally directed toward the west and south-southwest. The TKRM has significant hydrologic connectivity with Waccasassa Bay and the Gulf of Mexico. There is an eastern hydrologic corridor through the Spring Run system.

The hydrology on the site has been affected by a system of elevated roads, ditches, and culverts. These have, respectively, altered sheetflow in the hammock, drained both hammocks and deeper wetlands, and impounded water upstream of crossings.

1.1.3. Soils

According to the *Levy County Soil Survey* (USDA Natural Resources Conservation Service [NRCS], 1996), five natural soil mapping units occur on the property (Map 3). In their undisturbed state, the soils found on the site are described as poorly drained, nearly level, sandy, clay loams covering a coastal limestone bedrock layer. Three mapping units, Demory sandy clay loam, occasionally flooded (41); Wacasassa-Demory complex, flooded (39); and Wekiva fine sand (13) occupy over 90 percent of the site. Demory sandy clay loam is described as flooding occasionally while Wacassassa sandy clay loam occurs on low ridges and is described as flooding only rarely. Wekiva fine sand is poorly drained sand over clay loam. The latter occurs only on the extreme eastern edge of the site.

These mapped soil units are associated with hardwood hammock vegetation (NRCS 1996). Field observation indicates that Wacasassa sandy loams and Wekiva fine sand support upland (mesic) hardwood hammocks while the Demory sandy clay loams support hydric hardwood hammock. Within the latter, it is useful to distinguish a distinctly hydric coastal hammock from a more inland variant with the historic demarcation line approximating the eastern limit of soil mapping unit 41.

1.1.4. Vegetation

The vegetation on site includes both relatively natural and altered plant communities. For purposes of this mitigation plan, the vegetative cover types on-site (Map 4) have been assigned a land use code based on the Florida Land Use, Cover and Forms Classification System (FLUCFCS: Florida Department of Transportation [FDOT], 1999, as provided in the Southwest Florida Water Management District (SWFWMD) GIS database).

Approximately 4,626 acres of pine plantations occur on the TKRM with ages of the stands varying from 1 to 30 years. Additional acres of "natural" forest that has been timbered or high-graded is present, especially in the western and southern parts of the site. In plantations, trees were typically planted at a density of between 700 to 900 trees per acre. Individual tree heights vary from less than 8-ft to more than 50-ft high. According to 1943 aerial photographs and soil

data presented in the Levy County Soil Survey, the pine plantations are mostly located in areas that were historically coastal mesic and hydric hammocks, but are also planted in sites that were historically forested wetlands and even in areas that have somewhat saline soils and vegetation.

2. Methods

The vegetative sampling was conducted in October and November 2007. Vegetation was beginning to enter late fall and winter dormancy. However, all trees and most herbaceous species normally visible in late summer and fall were identifiable. Some species were at peak bloom.

Cut and uncut areas were sampled separately. Uncut areas were treated as references with which cut areas could be compared both for current and future conditions. Within each area, four strata were sampled: overstory (canopy), understory (sub-canopy), shrubs, and groundcover. These four strata were selected so that we could identify successional trends in the disturbed sites as well as identify the species composition of the natural forests.

2.1. Preliminary Mapping and Classification

Ecologists made preliminary maps of the TKRLM site using the Florida Land Use Cover and Forms Classification System (FLUCFCS). The resulting map was refined using soils maps and on-site soils investigations to further distinguish both natural and altered vegetation types. For purposes of this study, soil maps and on-site soils investigations, in combination with physiographic position, drainage observations, and existing vegetation were used to determine the likely historic vegetation and to classify major areas of current vegetation according to disturbance history. These observations were associated with the FLUCFCS map (Map 4), but are based on the original cover type, not current canopy cover. The FLUCFCS map shows existing vegetative cover including cleared areas and pine plantation.

2.2. Transects

Transects were located both in unaltered and altered plant communities (Map 5). Most transects were located within the TKRLM site. Additional transects were located in adjacent areas owned by Plum Creek to increase coverage of natural vegetative types that were found in low abundance within the TKRLM site.

All sampling occurred along transects. Total randomness of location was not possible given that there are only relatively small pockets of natural vegetation. However, transect locations were randomized to the greatest extent practicable, via selection of a random compass direction within the plant community with the direction constrained such that the transect remained within the community. Any transect that ran into a differing plant community was "bent" as needed to keep the transect within the target plant community.

Transects in altered plant communities were concentrated in areas not proposed for mining in order to increase precision in areas that would be evaluated for their potential inclusion in future mitigation planning.

2.3. Transect Sampling

2.3.1. Canopy / Overstory

In natural forests, canopy trees are typically fairly widely spaced and the most efficient means to get species richness and relative dominance are various forms of plotless sampling. In this study, canopy/overstory trees were defined as all species over 4 inches (10 cm) in diameter and "breast height" (4.5 ft above the ground).

Sampling occurred at 50-ft intervals along semi-randomly placed transects as described above (Bonham 1988, Mitchel 2007, Dahdooh-Guebas and Koedam 2006). A modified point-centered-quarter (PCQ) sampling program was used with the sampling interval set at 50-ft. In the few instances where this distance was inadequate to avoid overlap between sampled trees, the distance was increased at 25 ft intervals until no overlap occurred. The modification to standard PCQ sampling is that the closest two trees in each quadrant were recorded. Trees were recorded by species, the DBH was measured, and the distance from the closest tree in each quadrant to the sample point recorded (to the nearest foot). From this, density could be determined using standard PCQ formulas, but species composition was based on twice as many trees. DBH measurements were to the nearest centimeter.

2.3.2. Subcanopy/Understory

Sub-canopy or understory trees are defined as those smaller than canopy/overstory trees and greater than 1 inch in diameter. Sub-canopy trees are typically found as discrete, single-stemmed individuals. Sampling occurred at 50-ft intervals along semi-randomly placed transects (the same transect used for canopy sampling). Modified PCQ sampling was used, where the closest two sub-canopy trees in each quadrant were tallied by species. A minimum of 200 sub-canopy trees were tallied along each transect. Sizes of sub-canopy trees were not measured. Trees were recorded by species, and the distance from the closest tree in each quadrant to the sample point recorded (to the nearest foot).

2.3.3. Shrubs

Shrubs are defined as those woody plants smaller than sub-canopy/understory trees and greater than 3 ft (1 meter) in height. Shrubs included both tree saplings and true shrubs (typically multi-stemmed individuals that never attain tree height). Sampling occurred at 50-ft intervals along semi-randomly placed transects (the same transect used for canopy and sub-canopy sampling). The closest two shrubs in each quadrant were recorded by species. Shrubs were recorded by species, and the distance from the closest shrub in each quadrant to the sample point recorded (to the nearest foot). Sizes of shrub stems were not measured. This methodology recognizes the potential that the measurement point could fall in the center of a single, multi-stemmed, genetic individual.

2.3.4. Groundcover

Groundcover is defined as all non-woody species and any woody species below 3 ft (1 meter) in height. Sampling occurred at 50-ft intervals along semi-randomly placed transects (the same transect used for canopy and sub-canopy sampling).

A 6 ft line was positioned along each quadrant axis of the sample points selected along the transects. Any herbaceous species falling within 6 inches of the line was tallied. In effect, each is a miniature belt transect or narrow plot sample. Overall, there were 130 of these narrow plot samples per transect.

2.3.5. Rare Species

Rare species are typically not found effectively by PCQ or plot samples. To increase the list of species by habitat, a 20-minute timed wandering pedestrian search was made in the vicinity of each transect, but not necessarily along the transect. Any species not observed in the quantitative sampling was tallied and recorded according to its canopy, sub-canopy, shrub, or groundcover status. The rare plant searches was restricted to the habitat type of the associated transect.

3. Results

3.1. Transect Summaries

Results of transect sampling are presented in Appendix A.

3.2. Plant Community Descriptions

The TKRLM site is characterized by broad flats which historically supported a mesic to hydric hammock over a shallow limestone bed. This study was conducted, in part, because there is an apparent similarity across the overall site that makes land cover typing difficult. The difficulty is compounded by an even greater apparent similarity among disturbed plant communities, those converted to pine platation or cleared for silviculture.

A second goal of this study, providing a target for enhancement and restoration efforts, needs additionally to demonstrate how existing forest types differ from the original natural communities.

To facilitate these evaluations, the transect data were used to determine which of the species sampled are associated with natural forest conditions and which have been spread broadly across the site due to silviculture practices.

Appendix B provides a summary of the apparent affinity of each species for "natural" versus "disturbed" conditions. Species requiring undisturbed conditions were found predominantly in natural forests and have a high percent occurrence associated with natural forest in the sample. Species requiring disturbed conditions were found rarely (or never) in natural forests and have a very low percent occurrence for natural forest in the sample. Species tolerant of both conditions had intermediate values.

Species found 80% or more of the time in natural forest included *Vaccineum elliottii, Ilex myrtifolia, Cornus florida, Leitnera floridana, Gleditsea aquatica, Carya aquatica, Crataegus* sp., *Persea borbonea, Fraxinus caroliniana, Lyonia ferruginea, Serenoa repens, Crataegus spp.,* and *Carpinus caroliniana*. If these species are to occur in restored forests, they will likely need to be planted.

Species strongly associated with disturbance (occur in natural forest 20% or less of the time) included *Quercus geminata, Polypremum procumbens, Oxalis corniculata, Eupatorium*

capillifolium, Acer negundo, Morus rubra, Baccharus halimifolia, Diodia virginiana, Cercis canadensis, Vitis cinerea, Andropogon glomeratus, Melanthera nivea, Pinus elliottii, Melothria pendula, Iris hexagona, Ambrosia artemisiifolia, and *Callicarpa americana.* Many of these are typically considered to be early successional weedy species. Others, however, such as *Morus rubra*, *Vitis cinerea* and *Callicarpa americana,* were likely brought in from elsewhere by birds. *Pinus elliottii* may have been brought in purposefully for plantation regeneration. In all cases, these species will eventually disappear as restored areas mature into closed-canopied forests. Unless out-competing other species, none should need to be actively controlled.

3.2.1. Uplands

3.2.2. Mesic Hammock

Mesic Hammock occurs in better drained areas. These were mapped as FLUCFCS 425, FLUCFCS 427, or FLUCFCS 434 depending on the relative dominance of canopy species (Map 4). On the TKRM, they are found on shallow loamy soils over limerock. Fire frequency is low although fire scars were noted in most areas.

This community type was characterized by high species richness (32 species were observed in the overstory, 35 in the understory, 42 in the shrub layer, and 93 in the groundcover). On the TKRM, the temperate hardwood forests have an overstory characterized by sabal palm (*Sabal palmetto*), laurel oak (*Quercus laurifolia*), water oak (*Q. nigra*), blue-beech (*Carpinus caroliniana*), basswood *(Tilia americana)*, sweet-gum (*Liquidambar styraciflua*), live oak (*Q. virginiana*), slash pine *(Pinus elliottii)*, pignut hickory (*Carya glabra*) and eastern red cedar (*Juniperus virginiana*). Uncommon but distinctive species included hornbeam *(Ostrya virginiana)*, Shumard oak (*Q. shumardii*), white oak *(Q. alba)*, southern magnolia (*Magnolia grandiflora*), and white ash (*Fraxinus americana*). The most typical understory trees include Hercules' club (*Zanthoxylum clava-herculis*), blue-beech, water oak, American elm *(Ulmus americana)* pop ash *(Fraxinus caroliniana)*, winged elm *(Ulmus alata)*, hawthorn (*Crataegus spathulata* and *Crataegus* sp.), cornel (*Cornus foemina*), yaupon holly *(Ilex vomitoria)* and laurel oak. The Hercules' club was found predominantly in the one site sampled that was highly coastal in character. Other uncommon but characteristic species included flowering dogwood (*Cornus florida*) and flatwoods plum (*Prunus umbellata*). The shrub layer was dominated by smaller individuals of the same species including sabal palm, yaupon holly, and Florida maple. Saw palmetto (*Serenoa repens*) was the most common shrub species. Other shrubs that were characteristic but not common include *Sageretia minutiflora*, beautyberry (*Callicarpa americana*), gum bumelia (*Sideroxylon languinosum*), groundsel bush (*Baccharus glomerulifolia, B. halimifolia*), and American strawberry-bush (*Euonymus americanus*). The ground cover consists of saplings of trees, vines, and a variety of ferns, grasses, and herbs. The most abundant species were greenbriers *(Smilax auriculata, S. bona-nox)*, fern *(Thelypteris hispidula var. versicolor)*, poison ivy (*Toxicodendron radicans*), sabal palmetto, and panic grass. Less common but distinctive species included ovate maiden fern *(Thelypteris ovata)*, crossvine (*Bignonia capreolata*), slenderwood oats *(Chasmanthium laxum)*, rattanvine (*Berchemia scandens*), frostweed (*Verbesina virginica*), climbing anglepod *(Matelea gonocarpos)*, and pinewood dainties *(Phyllanthus liebmannianus* subsp. *platylepis).* This description is based on seven transects through relatively unaltered areas. It is probable that more pine was present historically since there was evidence of high grading in some of the sampled areas.

Table 3 provides species abundance data for canopy, subcanopy, shrub, and groundcover components of relatively unaltered hammocks, hammocks altered into pine plantation that is now relatively mature, and hammocks altered into pine plantation that is now either cleared or cleared and planted to young pines. The canopy, subcanopy, and shrub data represent the species providing 5 percent or more of the stems. The groundcover represents the species found in 10 percent or more of the 6-ft line tallies. Appendix C provides the complete data by plant community type.

Based on Table 1 below and Appendix C, it appears that many of the species most common in mesic hammocks are also present in pine plantations planted in areas that were originally hammock. The relative abundance, both in terms of density per acre and in terms of percent of stems, differs between natural and pine plantation areas even where the species are present in both. The pine plantations tend to have lower species richness in the canopy and subcanopy strata, but higher species richness in the groundcover– mostly due to species tolerant of disturbance.

With the exception of two nuisance species, disturbance species can be expected to decrease in abundance with time. Cogongrass and Japanese honeysuckle should be eradicated if found in preservation or restoration areas. Species not observed reproducing, or reproducing only in low abundance, that should be planted to hasten the succession in pine plantation areas include Shumard oak, red bay, southern magnolia, sweet-bay, climbing anglepod, saw palmetto, and ovate maidenfern. Slash pine and loblolly pine should be thinned where their abundance exceeds their abundance in the natural community by more than 20%. Specific recommendations for each species observed are provided in Table 2.

Table 1. Most abundant species by stratum and community type for upland mesic hammocks and plantation areas that were historically mesic hammock. "*" indicates a species found in the natural community that is present, but in low abundance, in the altered community.

Species	**Natural Mesic Hammock**	**Mesic Hammock Converted to Mature Pine Plantation**	**Mesic Hammock Converted to Young Pine Plantation**
Overstory (stems/acre, percent of stems)			
Acer rubrum		18 stems/ac; 8%	*
Carpinus caroliniana	22 stems/ac, 22%	27 stems/ac; 12%	*
Carya glabra	13 stems/ac; 5%		
Celtis laevigata		22 stems/ac; 5%	*
Juniperus virginiana		22 stems/ac; 5%	*
Liquidambar styraciflua	21 stems/ac, 9%	*	19 stems/ac; 7%
Pinus elliottii	15 stems/ac; 5%		146 stems/ac; 62%

Species	Natural Mesic Hammock	Mesic Hammock Converted to Mature Pine Plantation	Mesic Hammock Converted to Young Pine Plantation
Pinus taeda		216 stems/ac; 58%	156 stems/ac; 73%
Quercus laurifolia	43 stems/ac, 17%	21 stems/ac, 8%	*
Quercus nigra	28 stems/ac, 11%	*	*
Quercus virginiana	17 stems/ac; 7%	*	10 stems/ac, 9%
Sabal palmetto	53 stems/ac, 23%	*	*
Tilia americana var. *caroliniana*	21 stems/ac, 13%	*	*
Understory (stems/acre, percent of stems)			
Acer rubrum		33 stems/ac; 13%	*
Acer saccharum subsp. *floridanum*		81 stems/ac; 8%	178 stems/ac; 12%
Carpinus caroliniana	407 stems/ac, 22.5%	80 stems/ac; 13%	
Celtis laevigata		71 stems/ac; 8%	*
Cercis canadensis			143 stems/ac; 11%
Cornus foemina	117 stems/ac; 6%	*	*
Crataegus sp.	147 stems/ac, 9%	*	
Crataegus spathulata	113 stems/ac; 5%	*	
Diospyros virginiana			40 stems/ac; 6%
Fraxinus caroliniana	152 stems/ac, 7%		*
Ilex vomitoria	111 stems/ac	*	105 stems/ac; 16%
Juniperus virginiana			53 stems/ac; 6%
Liquidambar styraciflua			70 stems/ac; 9%
Myrica cerifera			111 stems/ac; 16%
Pinus elliottii			224 stems/ac; 21%
Pinus taeda		183 stems/ac; 14%	244 stems/ac; 17%
Quercus laurifolia	110 stems/ac; 7%	109 stems/ac; 15%	78 stems/ac; 5%
Quercus nigra	180 stems/ac, 10%	*	*
Quercus virginiana			48 stems/ac; 6%

Species	Natural Mesic Hammock	Mesic Hammock Converted to Mature Pine Plantation	Mesic Hammock Converted to Young Pine Plantation
Salix caroliniana			46 stems/ac; 7%
Ulmus alata	151 stems/ac; 8%	*	*
Ulmus americana	168 stems/ac, 10%	92 stems/ac; 9%	54 stems/ac; 5%
Tilia americana var. *caroliniana*		75 stems/ac; 6%	*
Zanthoxylum clava-herculis	414 stems/ac, 17%		118 stems/ac; 10%
Shrubs (stems/acre, percent of stems)			
Acer saccharum subsp. *floridanum*	100 stems/ac; 5%	138 stems/ac; 12%	152 stems/ac; 11%
Baccharis halimifolia			186 stems/ac; 16%
Callicarpa americana			81 stems/ac; 8%
Carpinus caroliniana		66 stems/ac; 9%	*
Celtis laevigata		134 stems/ac; 11%	*
Cornus foemina		108 stems/ac; 10%	*
Diospyros virginiana			50 stems/ac; 6%
Fraxinus americana			33 stems/ac; 7%
Ilex vomitoria	174 stems/ac; 9%	100 stems/ac; 10%	195 stems/ac; 16%
Juniperus virginiana		*	58 stems/ac; 6%
Myrica cerifera		52 stems/ac; 11%	84 stems/ac; 9%
Quercus laurifolia		59 stems/ac; 7%	*
Sabal palmetto	889 stems/ac, 50%	109 stems/ac; 18%	173 stems/ac; 20%
Serenoa repens	204 stems/ac, 14%		
Zanthoxylum clava-herculis			94 stems/ac; 8%
Groundcover (percent occurrence, species in 10 percent or more of plots within transect)			
Acmella oppositifolia var. *repens*			19%

Species	Natural Mesic Hammock	Mesic Hammock Converted to Mature Pine Plantation	Mesic Hammock Converted to Young Pine Plantation
Ampelopsis arborea			12%
Andropogon glomeratus			11%
Andropogon sp.			23%
Chasmanthium nitidum			15%
Commelina diffusa	12%		
Cyperaceae sp.			17%
Cyperus sp.	15%	15%	15%
Dichanthelium acuminatum			33%
Dichanthelium commutatum	14%	*	12%
Dichanthelium sp.			15%
Dichondra carolinensis			20%
Erigeron vernus	15%		
Eupatorium sp.			20%
Galium sp.			19%
Gelesium sempervirens	14%	*	
Hyptis alata			17%
Imperata cylindrical			19%
Lonicera japonica			15%
Mikania scandens			14%
Mitchella repens	11%		
Panicum anceps	14%		
Panicum sp.	20%		14%
Panicum rigidulum			35%
Paspalum sp.			12%
Pteridium aquilinum			12%
Quercus laurifolia	10%	*	

Species	Natural Mesic Hammock	Mesic Hammock Converted to Mature Pine Plantation	Mesic Hammock Converted to Young Pine Plantation
Quercus nigra	14%		
Rhynchospoa sp.	17%	*	12%
Rubus argutus		*	18%
Sabal palmetto	22%		
Scoparia dulcic			17%
Smilax auriculata	83%		
Smilax bona-nox	64%	64%	48%
Solidago odora			24%
Solidago sempervirens			19%
Stachys floridana			17%
Thelypteris hispidula var. *versicolor*	42%		
Thelypteris ovata	12%		
Toxicodendron radicans	23%	11%	15%
Trichostema dichotmum			12%
Unknown	23%		
Verbesina virginica			18%
Viola sororia			13%
Vitis cinerea			11%
Vitis rotundifolia		*	15%

Table 2. Summary of species occurrence in natural mesic hammocks and hammocks that have been converted to mature and young pine plantation. For restoration/enhancement, the last column provides recommendations for management:

- S – allow succession to take its course
- I – early successional plant, ignore and expect it to disappear as the restoration/enhancement matures
- R – nuisance exotic, remove
- E – rare or uncommon species to be encouraged
- P – characteristice species that will likely need to be planted to get it into most restoration/enhancement areas
- PC – characteristic species but only in coastal hammocks; will likely need to be planted to get it into those areas
- T – thin to more appropriate density.

Natural	Natural	Mature Plantation	Young Plantation	Recommendation
Acer rubrum	X	X	X	S
Acer saccharum subsp. *floridanum*	X	X	X	S
Acmella oppositifolia var. *repens*			X	I
Aeschynomene americana			X	I
Ambrosia artemisiifolia	X		X	I
Amorpha fruticosa			X	E
Ampelopsis arborea	X	X	X	S
Andropogon glomeratus	X		X	I
Andropogon virginicus			X	I
Aristolochia serpentaria	X	X		S
Asclepias perennis	X		X	S
Asplenium platyneuron			X	E
Baccharis glomeruliflora	X		X	I
Baccharis halimifolia	X		X	I
Berchemia scandens	X		X	S
Betula nigra	X			P
Bignonia capreolata	X	X	X	S
Callicarpa americana	X	X	X	S
Campsis radicans	X	X	X	S
Carphephorus odoratissimus			X	S
Carpinus caroliniana	X	X	X	S
Carya aquatica	X			P
Carya glabra	X	X	X	S
Celtis laevigata	X	X	X	S

Natural	Natural	Mature Plantation	Young Plantation	Recommendation
Centella asiatica	X		X	I
Cercis canadensis	X		X	P
Chamaesyce sp.			X	I
Chasmanthium laxum	X			P
Chasmanthium nitidum			X	I
Chenopodium sp.			X	I
Chionanthus virginicus			X	E
Clematis sp.			X	I
Commelina diffusa	X			I
Cornus florida	X			P
Cornus foemina	X	X	X	S
Crataegus sp.	X	X	X	S
Crataegus spathulata	X	X	X	S
Cyperus sp.	X	X	X	S
Desmodium sp.	X		X	I
Dichanthelium commutatum	X	X	X	S
Dichanthelium sp.	X	X	X	S
Dichondra carolinensis	X		X	S
Dicliptera sp.	X		X	I
Diospyros virginiana	X	X	X	I
Elephantopus carolinianus	X		X	E
Elytraria caroliniensis	X			P
Erigeron vernus	X			P
Erythrina herbacea	X			P
Euonymus americanus	X	X	X	S
Eupatorium capillifolium			X	I
Eupatorium mikanioides	X	X	X	S
Eupatorium perfoliatum			X	I
Eustachys glauca			X	I
Fraxinus americana	X	X	X	S
Fraxinus caroliniana	X		X	S
Fraxinus pennsylvanica		X		S
Galium aparine	X		X	I
Galium hispidulum			X	I
Gelsemium sempervirens	X	X		P
Hydrocotyle umbellata	X	X	X	S
Hypericum hypericoides	X		X	P
Hyptis alata	X		X	I
Ilex cassine	X		X	P
Ilex opaca	X			P
Ilex vomitoria	X	X	X	S
Imperata cylindrica			X	R
Ipomoea sp.			X	S

Natural	Natural	Mature Plantation	Young Plantation	Recommendation
Juncus sp.			X	I
Juniperus virginiana	X	X	X	S
Lamium sp.			X	I
Liquidambar styraciflua	X	X	X	S
Lonicera japonica	X		X	R
Lonicera sempervirens			X	E
Magnolia grandiflora	X		X	P
Magnolia virginiana	X			P
Mecardonia acuminata			X	I
Matelea gonocarpos	X	X		S
Melanthera nivea	X		X	I
Melothria pendula	X	X	X	S
Mikania scandens			X	I
Mitchella repens	X		X	E
Morus rubra		X	X	S
Myrica cerifera	X	X	X	S
Myrica heterophyla	X			P
Oplismenus hirtellus	X	X	X	S
Ostrya virginiana	X			P
Oxalis corniculata			X	I
Panicum anceps.	X			I
Panicum rigidulum			X	I
Panicum sp.	X		X	I
Parthenocissus quinquefolia	X	X	X	S
Paspalum setaceum			X	I
Paspalum sp.	X		X	I
Persea borbonia	X	X	X	S
Persea palustris	X		X	S
Phyla nodiflora			X	I
Phyllanthus liebmannianus subsp. *platylepis*	X		X	E
Pinus elliottii	X		X	T
Pinus taeda	X	X	X	T
Pluchea odorata			X	S
Polygonum hydropiperoides			X	I
Polypremum procumbens			X	I
Proserpinaca pectinata			X	I
Prunus caroliniana			X	S
Prunus serotina			X	I
Prunus umbellata	X			P
Ptelea trifoliata			X	E
Pteridium aquilinum			X	I
Quercus alba	X			P
Quercus incana			X	E

Natural	Natural	Mature Plantation	Young Plantation	Recommendation
Quercus laurifolia	X	X	X	S
Quercus michauxii			X	E
Quercus nigra	X	X	X	S
Quercus shumardii	X		X	S
Quercus virginiana	X	X	X	S
Rhus copallinum	X		X	I
Rhynchospora corniculata			X	I
Rhynchospora sp.	X	X	X	S
Rubus argutus	X	X	X	I
Rudbeckia triloba			X	E
Ruellia caroliniensis	X	X	X	S
Sabal palmetto	X	X	X	T
Sageretia minutiflora	X			P
Salix caroliniana		X	X	T
Salvia lyrata	X		X	I
Sambucus canadensis		X	X	T
Scirpus sp.			X	I
Scleria triglomerata	X			P
Scoparia dulcis			X	I
Serenoa repens	X		X	P
Sideroxylon lanuginosum	X	X	X	S
Sideroxylon lycioides			X	E
Sideroxylon reclinatum		X	X	E
Smilax auriculata	X			S
Smilax bona-nox	X	X	X	S
Smilax glauca			X	E
Smilax laurifolia	X			I
Smilax tamnoides	X	X	X	I
Solanum sp.	X		X	I
Solidago canadensis var. *scabra*			X	S
Solidago odora	X		X	S
Solidago sempervirens			X	I
Stachys floridana	X		X	I
Symphoricarpos orbiculatus			X	S
Taxodium sp.			X	S
Thelypteris hispidula var. *versicolor*	X			S
Thelypteris ovata	X		X	P
Tilia americana var. *caroliniana*	X	X	X	S
Toxicodendron radicans	X	X	X	S
Trichostema dichotomum			X	I
Ulmus alata	X	X	X	S
Ulmus americana	X	X	X	S
Vaccinium arboreum	X			P

Natural	Natural	Mature Plantation	Young Plantation	Recommendation
Verbesina virginica	X		X	P
Viburnum dentatum	X		X	P
Viburnum obovatum	X	X	X	S
Viola sororia	X		X	P
Vicia floridana		X		I
Vitis rotundifolia	X	X	X	W
Zamia pumila	X			PC
Zanthoxylum clava-herculis	X		X	PC

3.2.3. Coastal Mesic Hammock-Temperate Hardwoods

Inadequate coastal mesic hammock (one transect) was available to sample separately from the upland mesic hammock discussed above. What there was, was mapped as FLUCFCS 425. The species composition is similar to that of the upland mesic hammocks (and included in the species description above). Differences, while minor overall, include higher abundances of coontie (*Zamia pumila*), Hercules' club, and eastern red cedar.

3.2.4. Pine Flatwoods

Pine flatwoods once occupied the extreme eastern edge of the site. All flatwoods onsite or immediately off of it was overgrown due to fire exclusion. It was characterized by an overstory of slash pine (*Pinus elliottii*) with a substantial water oak component, a subcanopy characterized either by very little or by water oak and fetterbush (depending on state of overgrowth), a shrub layer of wax myrtle, cabbage palm, saw palmetto (*Serenoa repens*), and persimmon; and a limited abundance of herbaceous species. Minimal flatwoods exists onsite at this time; two transects were sampled as natural, one of them being immediately offsite to the east. Both were overgrown, one severely so.

Onsite, several altered areas were sampled. These were identified based on having "flatwoods soils," that is sandy Wekiva soils with spodic horizons that typically support flatwoods. One cleared area and one area converted to pine plantation were sampled.

The table below provides species abundance data for the dominant (top 10% of cover) canopy, subcanopy, shrub, and groundcover components of relatively unaltered flatwoods, flatwoods altered into pine plantation, and that is now cleared. Appendix C provides detailed summaries of each condition category.

The overgrown flatwoods had a dominance of oaks instead of pines, a high density of saw palmetto in the shrub layer, and predominantly woody species in the groundcover. Diversity was low (10 overstory species, 23 understory species, 19 shrub species, 39 ground cover species). However, in a truly unaltered, well maintained flatwoods, woody species richness would likely have been lower; groundcover species richness would likely be much higher. The young pine plantation had a sparse canopy and subcanopy dominated by loblolly pine. In the historic condition, slash or longleaf pine would likely have been dominant. It also had some presence of

oaks and sabal palms, but not in high numbers. Typical flatwoods shrubs were present in low abundance including saw palmetto, wax myrtle (*Myrica cerifera*), fetterbush, and rusty lyonia. The groundcover had only a few species that would be expected in flatwoods and was lacking or had only low abundance of such characteristic species as wiregrass *(Aristida stricta* var. *beyrichiana)*.

The cleared flatwoods, represented by a single transect, had a sparse canopy and subcanopy. A few slash pines had been left in the canopy as seed trees. Species richness was also low in the shrub stratum. By contrast, species richness was high in the ground cover (70 species) which displayed a mixture of native early successional grasses and herbs, seedlings and sprouts of woody species, and species characteristic of flatwoods groundcover.

Table 3. Most abundant species by stratum and community type for flatwoods and plantation areas that were historically flatwoods.

Species	Overgrown Flatwoods	Flatwoods Converted to Young Pine Plantation	Flatwoods Cleared for Pine Plantation
Overstory (stems/acre, percent of stems)			
Acer rubrum			17 stems/ac; 40%
Pinus elliottii	47 stems/ac; 28%		3 stems/ac; 7%
Pinus taeda		89 stems/ac; 68%	
Liquidambar styraciflua	10 stems/ac; 5%	16 stems/ac; 12%	3 stems/ac; 7%
Quercus laurifolia	36 stems/ac; 19%		
Quercus nigra	60 stems/ac, 34%	15 stems/ac; 11%	
Quercus virginiana	17 stems/ac; 9%		14 stems/ac, 33%
Ulmus americana			6 stems/ac; 13%
Subcanopy (stems/acre, percent of stems)			
Acer rubrum			120 stems/ac, 48%
Carpinus caroliniana	307 stems/ac; 9%		
Lyonia ferruginea	337 stems/ac, 15%		
Myrica cerifera		14 stems/ac; 8%	16 stems/ac; 6%
Pinus elliottii	91 stems/ac; 6%	*	
Pinus taeda	61 stems/ac; 5%	21 stems/ac; 13%	
Quercus laurifolia	258 stems/ac; 9%		

Species	Overgrown Flatwoods	Flatwoods Converted to Young Pine Plantation	Flatwoods Cleared for Pine Plantation
Quercus nigra	766 stems/ac; 37%	47 stems/ac; 47%	
Quercus virginiana		14 stems/ac; 8%	24 stems/ac; 10%
Sabal palmetto	161 stems/ac; 6%	16 stems/ac, 10%	40 stems/ac; 16%
Ulmus americana	273 stems/ac; 8%		
Viburnum obovatum	205 stems/ac; 6%		16 stems/ac; 6%*
Shrubs (stems/acre, percent of stems)			
Baccharis halimifolia			19 stems/ac; 8%
Callicarpa americana			16 stems/ac; 7%
Diospyros virginiana	30 stems/ac, 12%		12 stems/ac; 12%
Ilex glabra		14 stems/ac; 8%	
Lyonia ferruginea	242 stems/ac; 10%	18 stems/ac, 11%	
Lyona lucida	72 stems/ac; 6%	11 stems/ac; 7%	
Myrica cerifera	115 stems/ac; 7%	30 stems/ac, 18%	30 stems/ac; 18%
Pinus elliottii			14 stems/ac; 6%
Quercus nigra	150 stems/ac; 5%	32 stems/ac; 19%	32 stems/ac; 19%
Quercus virginiana	232 stems/ac; 7%	*	*
Sabal palmetto	289 stems/ac, 10%	23 stems/ac; 14%	47 stems/ac; 19%
Serenoa repens	946 stems/ac, 45%	18 stems/ac; 11%	30 stems/ac, 12%
Viburnum obovatum	199 stems/ac; 6%		
Groundcover (percent occurrence, species in 10 percent or more of plots within transect)			
Acmella oppositifolia var. *repens*			12%
Ampelopsis arborea			38%
Andropogon glomeratus	29%		35%
Centella asiatica			31%
Dichanthelium aciculare		14%	

Species	Overgrown Flatwoods	Flatwoods Converted to Young Pine Plantation	Flatwoods Cleared for Pine Plantation
Dichanthelium acuminatum			48%
Dichanthelium commutatum		12%	36%
Eupatorium capillifolium			15%
Eustachys glauca			14%
Gelesium sempervirens	14%		*
Hedyotis procumbens			15%
Ilex glabra	12%		
Ludwigia sp.			17%
Lyonia lucida	15%		
Mecardonia acuminate			15%
Melanthera nivea			15%
Melothria pendula			14%
Mikania scandens			50%
Mitchella repens	19%		
Myrica cerifera		12%	
Oxalis corniculata			23%
Panicum dichotomiflorum			14%
Panicum rigidulum			48%
Paspalum setaceum			15%
Paspalum sp.			15%
Polygonum hydropiperoides			41%
Pteridium aquilinum		40%	
Quercus laurifolia			
Quercus nigra	11%		
Rubus argutus			17%
Rudbeckia triloba			12%
Saccharum giganteum			31%

Species	Overgrown Flatwoods	Flatwoods Converted to Young Pine Plantation	Flatwoods Cleared for Pine Plantation
Serenoa repens	15%	*	
Smilax auriculata			
Smilax bona-nox	43%	27%	14%
Viburnum obovatum	12%		
Vitis cinerea			15%
Vitis rotundifolia			

Table 4. Summary of species occurrence in natural flatwoods and flatwoods that have been converted to young pine plantation or cleared. For restoration/enhancement, the last column provides recommendations for management:

- S – allow succession to take its course
- I – early successional plant, ignore and expect it to disappear as the restoration/enhancement matures
- R – nuisance exotic, remove
- E – rare or uncommon species to be encouraged
- P – characteristice species that will likely need to be planted to get it into most restoration/enhancement areas
- W – watch, control if it becomes overly abundant

Species	Natural	Young Plantation	CLEARED	Recommended Management
Acer negundo	X		X	I
Acer rubrum		X	X	S
Acmella oppositifolia var. *repens*			X	I
Ampelopsis arborea	X		X	S
Andropogon glomeratus	X		X	I
Andropogon sp.	X			I
Andropogon virginicus	X		X	I
Aristida sp.	X	X		E
Asclepias perennis	X			S
Axonopus affinis			X	I
Baccharis halimifolia	X		X	I
Callicarpa americana		X	X	S
Carpinus caroliniana	X			S

Species	Natural	Young Plantation	CLEARED	Recommended Management
Centella asiatica			X	I
Cephalanthus occidentalis		X	X	S
Chionanthus virginicus	X	X		E
Cirsium nuttallii			X	I
Crataegus sp.	X			S
Cyperus polystachyos	X		X	I
Dichanthelium aciculare		X	X	S
Dichanthelium acuminatum			X	S
Dichanthelium commutatum		X	X	S
Dichanthelium sp.	X			S
Dichondra carolinensis	X			S
Diospyros virginiana	X	X	X	S
Elytraria caroliniensis			X	S
Erigeron vernus	X			I
Eupatorium capillifolium			X	I
Eupatorium sp.			X	I
Eustachys glauca			X	I
Fraxinus americana	X			S
Galium hispidulum			X	I
Galium sp.			X	I
Gelsemium sempervirens	X	X	X	S
Hedyotis procumbens			X	S
Hydrocotyle umbellata			X	I
Hypericum hypericoides	X			E
Hypericum sp.			X	E
Hyptis alata		X	X	I
Ilex cassine		X		S
Ilex glabra	X	X		S
Ilex vomitoria	X		X	S
Lachnocaulon anceps	X			S
Liquidambar styraciflua	X	X	X	S
Ludwigia sp.			X	W
Lyonia ferruginea	X	X		S
Lyonia lucida	X	X		S
Lythrum alatum			X	I
Magnolia grandiflora		X		S
Magnolia virginiana	X		X	S
Mecardonia acuminata			X	I
Melanthera nivea			X	I
Melothria pendula			X	S
Mikania scandens			X	I
Mitchella repens	X			I
Myrica cerifera	X	X	X	S
Oxalis corniculata			X	I
Panicum anceps			X	I

Species	Natural	Young Plantation	CLEARED	Recommended Management
Panicum dichotomiflorum	X		X	S
Panicum rigidulum	X		X	I
Parthenocissus quinquefolia			X	W
Paspalum sp.	X		X	I
Paspalum setaceum			X	I
Paspalum urvillei			X	I
Passiflora incarnata			X	I
Persea borbonia	X		X	E
Phyllanthus liebmannianus subsp. *platylepis*			X	E
Physalis sp.			X	I
Pinus elliottii	X		X	T
Pinus taeda	X	X		T
Polygonum hydropiperoides			X	I
Polypremum procumbens			X	I
Pteridium aquilinum		X		S
Quercus geminata			X	S
Quercus laurifolia	X	X		S
Quercus nigra	X	X		S
Quercus virginiana	X	X	X	S
Rhynchospora colorata			X	I
Rubus argutus	X		X	I
Rudbeckia triloba		X	X	E
Sabal palmetto	X	X	X	S
Saccharum giganteum			X	S
Salvia lyrata	X			I
Serenoa repens	X	X	X	E
Sesbania herbacea			X	I
Sideroxylon lanuginosum	X			E
Sideroxylon sp.			X	E
Smilax auriculata	X			W
Smilax bona-nox		X	X	W
Smilax laurifolia			X	W
Solidago odora	X			I
Toxicodendron radicans	X		X	S
Ulmus alata	X			P
Ulmus americana	X		X	S
Vaccinium arboreum	X			P
Vaccinium corymbosum	X			P
Vaccinium elliottii	X			P
Vaccinium myrsinites	X	X		P
Verbesina virginica			X	S
Vernonia angustifolia			X	S
Viburnum obovatum	X	X		S
Vicia acuta			X	I

Species	Natural	Young Plantation	CLEARED	Recommended Management
Viola sororia			X	S
Vitis cinerea			X	S
Vitis rotundifolia	X	X	X	W

3.3. Wetlands

3.3.1. Hydric Hammock

This vegetative cover type represents remnants of the hydric hammock that once dominated most of the more inland areas on this site. It is characterized by a diverse canopy (29 species recorded on transects) consisting primarily of a pine-hardwood canopy dominated by loblolly pine *(Pinus taeda)* and various oaks (predominantly laurel and live oak). Also abundant are water locust (*Gleditsia aquatica*), pop ash (*Fraxinus caroliniana*), eastern red cedar (*Juniperus virginiana*), sweet-gum *(Liquidambar styraciflua)*, sabal palm (*Sabal palmetto*), sweet-bay (*Magnolia virginiana*), and American elm (*Ulmus americana*). The subcanopy and shrub layers are also diverse (42 and 34 species respectively, recorded on the transects) and contain mostly the same species plus a variety of smaller species including Florida maple (*Acer saccharum* subsp. *floridanum*), yaupon holly, and American hornbeam (*Carpinus caroliniana*). This community is variable in character depending on minor changes in topography and depth to bedrock. Small inclusions of better drained areas include species usually associated with uplands, including some saw palmetto (*Serenoa repens*), pignut hickory (*Carya glabra*) and redbud (*Cercis canadensis*). Inclusions of more poorly drained areas have a greater abundance of characteristic wetland species such as American elm and pop ash. The groundcover is fairly sparse and not highly diverse. It consists primarily of woody seedlings, vines, and a few shade-tolerant grasses. Most abundant groundcover species are associated predominantly with wetlands. The areas sampled were disturbed to some degree. It is probable that there have been shifts in canopy dominance due to high-grading (selective logging).

Most of the characteristic species were also found in young pine plantations and cleared areas. Exceptions included water locust and water hickory which were absent or under-represented. There was little consistency in what was present or absent in the three altered community types sampled; that is, clear successional patterns were not apparent. However, the altered areas consistently included more red maple (*Acer rubrum*), boxelder (*Acer negundo*), and groundsel bush (*Baccharus halimifolia*). The plantations had more pine than found in the natural communities.

Table 5 provides species abundance data for canopy, subcanopy, shrub, and groundcover components of relatively unaltered hydric hammocks, hammocks altered into pine plantation that is now relatively mature, and hammocks altered into pine plantation that is now either cleared or cleared and planted to young pines. Appendix C provides detailed summaries of each condition category.

In its natural state, this community type was mapped as FLUCFCS 630 on the land use map. Mature pine plantation was mapped as 6291; young pine plantation as 6292, and cleared areas as 6301.

Table 5. Most abundant species by stratum and community type for hydric hammocks and plantation areas that were historically hydric hammock.

Species	Hydric Hammock	Hydric Hammock Converted to Mature Pine Plantation	Hydric Hammock Converted to Young Pine Plantation	Hydric Hammock Cleared
Overstory (stems/acre, percent of stems)				
Acer negundo			14 stems/ac; 36%	
Acer rubrum		26 stems/ac; 8%	5 stems/ac; 13%	19 stems/ac; 19%
Carpinus caroliniana				4 stems/ac; 10%
Cercis canadensis				5 stems/ac; 12%
Fraxinus caroliniana	22 stems/ac; 10%		3 stems/ac; 9%	4 stems/ac; 6%
Gleditsia aquatica	21 stems/ac; 9%			
Juniperus virginiana	38 stems/ac; 14%	48 stems/ac; 14%		16 stems/ac; 33%
Liquidambar styraciflua	31 stems/ac; 11%	61 stems/ac; 18%	3 stems/ac; 7%	
Magnolia virginiana	20 stems/ac; 6%	*		
Pinus taeda	76 stems/ac; 23%	111 stems/ac; 54%	24 stems/ac; 60%	
Quercus laurifolia	53 stems/ac; 20%	38 stems/ac; 12%	7 stems/ac; 17%	15 stems/ac; 30%
Quercus nigra			14 stems/ac; 30%	4 stems/ac; 6%
Quercus virginiana	19 stems/ac; 6%		3 stems/ac; 7%	9 stems/ac; 19%
Sabal palmetto	20 stems/ac; 8%	*		
Ulmus alata			3 stems/ac; 5%	
Ulmus americana	19 stems/ac; 7%	*	10 stems/ac; 26%	6 stems/ac; 9%
Subcanopy (stems/acre, percent of stems)				
Acer negundo			217 stems/ac; 23%	
Acer rubrum	39 stems/ac; 8%	95 stems/ac; 9%		54 stems/ac; 13%
Acer saccharum subsp. *floridanum*	57 stems/ac; 9%	63 stems/ac; 6%	*	
Baccharus halimifolia		130 stems/ac; 5%	186 stems/ac; 18%	
Carpinus caroliniana	36 stems/ac; 8%			365 stems/ac; 32%

Species	Hydric Hammock	Hydric Hammock Converted to Mature Pine Plantation	Hydric Hammock Converted to Young Pine Plantation	Hydric Hammock Cleared
Carya aquatica	58 stems/ac; 15%		*	
Diospyros virginiana	17 stems/ac; 5%	156 stems/ac; 6%	*	
Fraxinus americana	64 stems/ac; 12%	169 stems/ac; 15%		
Fraxinus caroliniana	44 stems/ac; 17%			*
Gleditsia aquatica	18 stems/ac; 8%			
Ilex vomitoria	95 stems/ac; 12%	*	*	*
Juniperus virginiana	83 stems/ac; 14%	559 stems/ac; 26%	*	169 stems/ac; 22%
Liquidambar styraciflua		*		31 stems/ac; 22%
Magnolia grandiflora				19 stems/ac; 7%
Myrica cerifera	31 stems/ac; 6%	*	73 stems/ac; 6%	
Ostrya virginiana		190 stems/ac; 17%		
Pinus elliottii			206 stems/ac; 15%	
Pinus taeda		330 stems/ac; 13%	462 stems/ac; 62%	
Quercus laurifolia	40 stems/ac; 9%	*	70 stems/ac; 8%	89 stems/ac; 23%
Rhus copallinum		545 stems/ac; 21%		
Sabal palmetto	26 stems/ac; 6%	*		*
Salix caroliniana	16 stems/ac; 10%		*	
Ulmus alata	31 stems/ac; 6%	*	*	30 stems/ac; 14%
Ulmus americana	42 stems/ac; 7%	*	*	108 stems/ac; 16%
Viburnum obovatum			90 stems/ac; 7%	
Shrubs (stems/acre, percent of stems)				
Acer negundo			98 stems/ac; 9%	
Acer saccharum subsp. *floridanum*	38 stems/ac; 6%		*	
Baccharis halimifolia		504 stems/ac; 19%	463 stems/ac; 55%	380 stems/ac; 56%
Fraxinus americana	30 stems/ac; 6%	*		

Species	Hydric Hammock	Hydric Hammock Converted to Mature Pine Plantation	Hydric Hammock Converted to Young Pine Plantation	Hydric Hammock Cleared
Fraxinus caroliniana	29 stems/ac; 17%		*	
Ilex vomitoria	88 stems/ac; 13%	364 stems/ac; 24%	46 stems/ac; 5%	44 stems/ac; 9%
Juniperus virginiana			*	
Liquidambar styraciflua			44 stems/ac; 5%	
Myrica cerifera	94 stems/ac; 18%	158 stems/ac; 14%	*	*
Pinus taeda			54 stems/ac; 6%	
Rubus argutus		1360 stems/ac; 52%		
Sabal palmetto	246 stems/ac; 49%	390 stems/ac; 36%	*	46 stems/ac; 14%
Serenoa repens		144 stems/ac; 6%		*
Viburnum obovatum			143 stems/ac; 11%	
Groundcover (percent occurrence, species in 10 percent or more of plots within transect)				
Acer rubrum			15%	
Acer negundo			14%	
Acmella oppisitifolia var. *repens*				35%
Ampelopsis arborea	10%		*	*
Andropogon glomeratus			57%	
Andropogon virginicus		12%		
Baccharis halimifolia		23%		
Campsis radicans	14%		*	
Carpinus caroliniana	15%			
Centella asiatica	12%		44%	14%
Chasmanthium laxum	17%	25%	*	*
Cirsium horridulum			27%	
Conoclinium coelestinum				15%

Species	Hydric Hammock	Hydric Hammock Converted to Mature Pine Plantation	Hydric Hammock Converted to Young Pine Plantation	Hydric Hammock Cleared
Coreopsis sp.				12%
Cyperaceae sp.				10%
Cyperus sp.	17%		41%	24%
Dichanthelium commuatum	10%	*	*	24%
Dichanthelium sp.	18%	*	35%	21%
Dichondra carolinensis			11%	10%
Dicliptera sp.	17%		27%	
Eupatorium capillifolium				34%
Hypericum brachyphyllum			12%	
Hypericum hypericoides		14%	*	
Hypericum myrtifolium				14%
Hyptis alata			17%	
Ludwigia repens				14%
Mecardonia acuminata				42%
Melanthera nivea			17%	
Melothria pendula			25%	
Mikania cordifolia			19%	17%
Mikania scandens			18%	
Mitchella repens			33%	
Oplismenus hirtellus		25%		
Oxalis corniculata			19%	
Panicum sp.	23%		19%	
Panicum rigidulum	16%		*	
Parthenocissus quinquifolia			14%	

Species	Hydric Hammock	Hydric Hammock Converted to Mature Pine Plantation	Hydric Hammock Converted to Young Pine Plantation	Hydric Hammock Cleared
Phyla nodiflora			23%	11%
Pinus taeda				19%
Quercus laurifolia		17%		
Rhynchospora corniculata.				25%
Rhynchospora sp.				10%
Ruellia caroliniensis		12%		
Rubus argutus		65%	38%	
Sabal palmetto	18%	71%		*
Saccharum giganteum	15%			
Salvia lyrata			14%	
Smilax bona-nox	36%	24%	31%	10%
Solidago leavenworthii		35%		
Solidago odora			22%	17%
Stenotaphrum secundatum	18%			
Teucrium canadense			12%	
Thelypteris kunthii			14%	23%
Thelypteris sp.		52%		
Toxicodendron pubescens	15%			
Toxicodendron radicans	10%	14%	*	
Viburnum dentatum				19%
Viola sororia		11%	20%	
Vitis cinerea			15%	
Vitis rotundifolia		40%	19%	

Table 6. Summary of species occurrence in natural hydric hammock and hydric hammocks that have been converted to pine plantation or cleared. For restoration/enhancement, the last column provides recommendations for management:

- S – allow succession to take its course
- I – early successional plant, ignore and expect it to disappear as the restoration/enhancement matures
- E – rare or uncommon species to be encouraged
- P – characteristice species that will likely need to be planted to get it into most restoration/enhancement areas
- W – watch and thin if the species becomes overly abundant

	Natural	Mature Plantation	Young Plantation	CLEARED	Recommended Management
Acer negundo	X		X		S
Acer rubrum		X		X	S
Acer saccharinum	X				S
Acer saccharum subsp. *floridanum*	X	X	X		S
Acmella oppositifolia var. *repens*			X	X	I
Ambrosia artemisiifolia			X		I
Amorpha fruticosa	X				S
Ampelopsis arborea	X		X	X	W
Andropogon glomeratus			X	X	I
Andropogon virginicus		X		X	I
Aralia spinosa				X	S
Asclepias perennis	X				S
Asplenium platyneuron			X		S
Axonopus affinis				X	I
Baccharis halimifolia	X	X	X	X	I
Berchemia scandens	X		X	X	S
Betula nigra		X			S
Bignonia capreolata				X	S
Boehmeria cylindrica		X	X		S
Botrychium biternatum	X				S
Callicarpa americana	X	X	X	X	S
Campsis radicans	X		X		S
Canna flaccida				X	I
Carpinus caroliniana	X		X	X	S
Carya aquatica	X		X		P
Carya glabra	X	X	X	X	S
Carya sp.	X				S
Celtis laevigata	X	X	X	X	S
Centella asiatica	X		X	X	S
Cephalanthus occidentalis	X	X			S

	Natural	Mature Plantation	Young Plantation	CLEARED	Recommended Management
Cercis canadensis		X	X	X	S
Chasmanthium laxum	X	X	X	X	S
Chrysopsis subulata			X	X	I
Cirsium horridulum			X		I
Cladium jamaicense	X				I
Clematis sp.	X				S
Conoclinium coelestinum	X			X	S
Coreopsis sp.				X	S
Cornus florida	X				P
Cornus foemina	X		X		S
Crataegus sp.	X		X		P
Crataegus spathulata	X				P
Cyperaceae sp1.				X	I
Cyperus polystachyos				X	I
Cyperus sp.	X		X	X	I
Desmodium sp.			X		I
Dichanthelium commutatum	X	X	X	X	S
Dichanthelium sp.	X		X	X	S
Dichondra carolinensis	X	X	X	X	S
Dicliptera sp.	X		X		S
Diospyros virginiana	X	X	X	X	S
Elephantopus carolinianus	X				S
Elytraria caroliniensis	X		X		S
Eragrostis spectabilis	X				S
Erechtites hieracifolia				X	I
Eryngium yuccifolium			X		S
Euonymus americanus			X		S
Eupatorium capillifolium			X	X	I
Eupatorium mikanioides	X				I
Eupatorium perfoliatum				X	I
Eupatorium serotinum					I
Eustachys petraea				X	I
Fraxinus americana	X	X			S
Fraxinus caroliniana	X		X	X	S
Fraxinus sp.			X		S
Galium hispidulum			X		I
Galium tinctorium		X			I
Gelsemium sempervirens			X		S
Gleditsia aquatica	X				P
Hydrocotyle umbellata	X		X	X	S
Hypericum brachyphyllum			X		S
Hypericum hypericoides	X	X	X	X	S
Hypericum myrtifolium				X	S
Hyptis alata			X		S
Ilex cassine	X			X	S

	Natural	Mature Plantation	Young Plantation	CLEARED	Recommended Management
Ilex myrtifolia	X				P
Ilex vomitoria	X	X	X	X	S
Iris hexagona	X	X	X	X	S
Itea virginica			X		S
Juncus sp.			X	X	I
Juniperus virginiana	X	X	X	X	S
Leitneria floridana	X				E
Liquidambar styraciflua	X	X	X	X	S
Ludwigia repens				X	S
Ludwigia sp.				X	W
Magnolia grandiflora	X	X		X	S
Magnolia virginiana	X	X	X	X	S
Mecardonia acuminata			X	X	I
Melanthera nivea			X	X	I
Melothria pendula			X	X	I
Mikania cordifolia			X	X	I
Mikania scandens	X		X	X	S
Mitchella repens	X		X	X	S
Monarda punctata				X	I
Morus rubra		X			S
Myrica cerifera	X	X	X	X	S
Oplismenus hirtellus	X	X		X	S
Osmunda cinnamomea	X				P
Ostrya virginiana	X	X			S
Oxalis corniculata			X	X	I
Panicum rigidulum	X		X		S
Panicum sp.	X		X		S
Parthenocissus quinquefolia	X	X	X	X	S
Paspalum floridanum				X	I
Paspalum sp.				X	I
Paspalum urvillei				X	I
Passiflora incarnata			X		I
Persea borbonia	X	X			P
Persea palustris	X	X		X	S
Phyla nodiflora	X		X	X	S
Physostegia purpurea			X		S
Physostegia sp.			X		S
Phytolacca americana				X	I
Pinus elliottii	X		X		T
Pinus taeda	X	X	X	X	T
Pluchea odorata			X		I
Pluchea rosea				X	I
Poaceae sp.				X	W
Polygonum hydropiperoides			X		I
Polypremum procumbens			X	X	I

	Natural	Mature Plantation	Young Plantation	CLEARED	Recommended Management
Populus deltoides	X		X		S
Prunus caroliniana	X		X		S
Prunus serotina			X		S
Prunus umbellata			X		S
Pteridium aquilinum				X	S
Quercus geminata			X		S
Quercus laurifolia	X	X	X	X	S
Quercus nigra	X		X	X	
Quercus shumardii	X	X			
Quercus virginiana	X		X	X	
Rhynchospora corniculata				X	I
Rhynchospora sp.			X	X	I
Rhus copallinum		X	X		I
Rubus argutus		X	X	X	I
Ruellia caroliniensis		X		X	S
Sabal palmetto	X	X	X	X	S
Saccharum baldwinii			X		S
Saccharum giganteum	X				S
Salix caroliniana	X		X	X	S
Salvia lyrata			X	X	S
Sambucus canadensis			X		I
Scleria triglomerata	X			X	S
Scoparia dulcis			X		I
Serenoa repens	X	X	X	X	S
Sideroxylon lanuginosum	X		X		S
Sideroxylon sp.			X		S
Smilax bona-nox	X	X	X	X	W
Solanum sp.			X	X	W
Solidago fistulosa			X		I
Solidago leavenworthii		X			I
Solidago odora			X	X	I
Solidago stricta			X		I
Sporobolus junceus	X				P
Stachys floridana	X				I
Stenotaphrum secundatum	X				I
Strophostyles umbellata			X		I
Taxodium distichum	X				S
Teucrium canadense			X		I
Thelypteris hispidula var. *versicolor*	X				S
Thelypteris kunthii			X	X	S
Thelypteris sp.	X	X		X	S
Tilia americana var. *caroliniana*	X	X	X		S
Toxicodendron pubescens	X				S
Toxicodendron radicans	X	X	X		S
Trichostema dichotomum		X			I

	Natural	Mature Plantation	Young Plantation	CLEARED	Recommended Management
Ulmus alata	X	X	X	X	S
Ulmus americana	X	X	X		S
Verbesina virginica			X		S
Viburnum obovatum	X			X	S
Vernonia angustifolia				X	S
Viburnum dentatum				X	S
Viburnum obovatum			X	X	S
Vicia acuta				X	I
Viola sororia		X		X	S
Vitis cinerea			X	X	W
Vitis rotundifolia	X	X	X		W
Yucca filamentosa	X		X		S
Zamia pumila		X			S
Zanthoxylum clava-herculis	X	X			S

3.3.2. Hydric Coastal Hammock

Hydric coastal hammocks occur along the western side of the tract but are sufficiently close to the Gulf that they may be inundated by salty or brackish water during extreme storm events with storm surges that are pushed inland by storm winds and tides. They are similar to the hydric hammocks that are more inland but are distinguished from them by vegetation with a higher dominance by cabbage palms and eastern red cedar (*Juniperus virginiana*). Associates include winged elm, laurel oak, blue-beech and yaupon holly. St. Augustine grass (*Stenotaphrum secundatum*) is abundant in the groundcover. Included within this mapping unit are small areas of coastal mesic hammock. The hydric coastal hammock was delimited from the hydric hammock based on the eastern limit of soil mapping unit 41 in combination with signatures on recent aerial photographs. On the ground, these systems are "diffuse" in the sense that the change between them is gradual. Based on information contained in Wolfe (1990), the delineation represents the saline water inundation level during tropical storm events (a hurricane could push saline water further inland).

Table 7 provides species abundance data for canopy, subcanopy, shrub, and groundcover components of relatively unaltered hammocks, hammocks altered into pine plantation that is now relatively mature, and hammocks altered into pine plantation that is now either cleared or cleared and planted to young pines. Appendix C provides detailed summaries of each condition category.

Hydric coastal hammock was mapped as FLUCFCS 633 on the land cover map. Areas converted to pine plantation were mapped as 6291.

Table 7. Most abundant species by stratum and community type for hydric coastal hammocks and plantation areas that were historically mesic hammock.

Species	Coastal Hydric Hammock	Coastal Hydric Hammock Converted to Mature Pine Plantation
Overstory (stems/acre, percent of stems)		
Carpinus caroliniana	14 stems/ac; 5%	
Juniperus virginiana	64 stems/ac; 24%	43 stems/ac; 14%
Liquidambar styraciflua	25 stems/ac; 10%	
Pinus taeda	42 stems/ac; 15%	68 stems/ac; 23%
Quercus laurifolia	20 stems/ac; 8%	40 stems/ac; 14%
Quercus virginiana		49 stems/ac; 16%
Sabal palmetto	66 stems/ac; 28%	46 stems/ac; 15%
Tilia americana var. *caroliniana*	23 stems/ac; 9%	
Ulmus americana		20 stems/ac; 7%
Subcanopy (stems/acre, percent of stems)		
Acer saccharum subsp. *floridanum*	69 stems/ac; 9%	
Carpinus caroliniana	128 stems/ac; 22%	
Ilex vomitoria	143 stems/ac; 15%	146 stems/ac; 9%
Juniperus virginiana	68 stems/ac; 7%	113 stems/ac; 7%
Liquidambar styraciflua	55 stems/ac; 10%	
Myrica cerifera	32 stems/ac; 10%	146 stems/ac; 9%
Quercus laurifolia		260 stems/ac; 15%
Quercus virginiana		227 stems/ac; 14%
Sabal palmetto	207 stems/ac; 40%	146 stems/ac; 9%
Ulmus alata	33 stems/ac; 6%	211 stems/ac; 12%
Ulmus americana		130 stems/ac; 8%
Shrubs (stems/acre, percent of stems)		
Acer saccharum subsp. *floridanum*	56 stems/ac; 9%	

Species	Coastal Hydric Hammock	Coastal Hydric Hammock Converted to Mature Pine Plantation
Carpinus caroliniana	47 stems/ac; 8%	
Cornus foemina	39 stems/ac; 7%	
Ilex vomitoria	160 stems/ac; 22%	552 stems/ac; 33%
Leitnera floridana	17 stems/ac; 6%	
Myrica cerifera	45 stems/ac; 16%	146 stems/ac; 9%
Sabal palmetto	296 stems/ac; 39%	845 stems/ac; 50%
Ulmus alata	68 stems/ac; 12%	
Groundcover (percent occurrence, species in 10 percent or more of plots within transect)		
Chasmanthium laxum	12%	
Cyperus sp.	12%	
Dichanthelium commuatum	21%	
Dichanthelium sp.	26%	21%
Ilex vomitoria	15%	23%
Myrica cerifera		12%
Oplismenus hirtellus	14%	
Paspalum notatum	15%	
Sabal palmetto	34%	
Smilax bona-nox	28%	33%
Stenotaphrum secundatum	15%	
Thelypteris kunthii	12%	

Table 8. Summary of species occurrence in natural coastal hydric hammock and coastal hydric hammocks that have been converted to pine plantation. For restoration/enhancement, the last column provides recommendations for management:

- S – allow succession to take its course
- I – early successional plant, ignore and expect it to disappear as the restoration/enhancement matures
- R – nuisance exotic, remove
- E – rare or uncommon species to be encouraged
- P – characteristice species that will likely need to be planted to get it into most restoration/enhancement areas
- W - watch and thin if the species becomes overly abundant.

Species	Natural	Mature Plantation	Recommended Management
Acer rubrum	X	X	S
Acer saccharum subsp. floridanum	X		P
Berchemia scandens	X		P
Betula nigra	X		S
Bidens sp.	X		I
Bignonia capreolata	X		P
Callicarpa americana	X		P
Carpinus caroliniana	X		P
Carya aquatica	X		S
Carya glabra	X	X	S
Celtis laevigata	X	X	S
Centella asiatica	X		S
Cephalanthus occidentalis		X	S
Chasmanthium laxum	X		S
Cladium jamaicense		X	S
Cornus foemina	X		P
Crataegus sp.	X		S
Cynanchum scoparium	X		S
Cyperus sp.	X	X	S
Dichanthelium commutatum	X	X	S
Dichanthelium sp.	X	X	S
Dichondra carolinensis		X	S
Diodia virginiana	X		S
Diospyros virginiana	X	X	S
Elytraria caroliniensis	X		S
Eragrostis spectabilis	X		S
Euonymus americanus	X		P
Eupatorium capillifolium	X		I
Fraxinus americana	X		P

Species	Natural	Mature Plantation	Recommended Management
Fraxinus pennsylvanica	X		S
Fraxinus sp.	X		S
Hydrocotyle umbellata	X	X	S
Ilex cassine	X	X	S
Ilex vomitoria	X	X	S
Juniperus virginiana	X	X	S
Leitneria floridana	X		E
Liquidambar styraciflua	X	X	S
Magnolia grandiflora		X	S
Magnolia virginiana	X		P
Matelea gonocarpus	X		E
Mikania scandens	X		S
Morus rubra	X		P
Myrica cerifera	X	X	S
Oplismenus hirtellus	X	X	S
Osmunda cinnamomea	X		P
Ostrya virginiana	X		P
Panicum sp.	X	X	S
Parthenocissus quinquefolia	X		S
Paspalum notatum	X		W
Paspalum sp.	X		I
Persea borbonia	X		P
Persea palustris	X	X	S
Persea sp.	X		S
Pinus elliottii	X		S
Pinus taeda	X	X	T
Ptelea trifoliata	X		P
Quercus laurifolia	X	X	S
Quercus nigra	X	X	S
Quercus shumardii	X		P
Quercus virginiana	X	X	S
Rhynchospora sp.	X		S
Rubus argutus	X		I
Ruellia caroliniensis	X		S
Sabal palmetto	X	X	S
Salix caroliniana		X	S
Serenoa repens		X	S
Smilax bona-nox	X	X	S
Smilax tamnoides	X		S
Stenotaphrum secundatum	X		S
Thelypteris kunthii	X		S
Tilia americana var. *caroliniana*	X	X	S
Toxicodendron pubescens		X	S
Toxicodendron radicans	X	X	S
Ulmus alata	X	X	S

Species	Natural	Mature Plantation	Recommended Management
Ulmus americana	X	X	S
Verbesina virginica	X		S
Viola sororia	X		S
Vitis rotundifolia	X		W
Zamia pumila	X		P
Zanthoxylum clava-herculis	X		P

3.3.3. Hydric Oak Hammocks

This community type mostly occurs in low flatlands inland of the coastal zone. It is dominated by laurel, water, and live oaks with a substantial component of sweet-gum and red bay. The subcanopy was more diverse and in addition to the species found in the canopy, included winged elm, blue-beech, yaupon holly and Florida maple in abundance. The shrub layer included abundant wax myrtle and small sabal palms. The groundcover was sparse and consisted mostly of vines and small woody plants of the same species in the higher strata, likely due to low light conditions. These hydric oak hammocks were generally mapped as FLUCFCS 628 on the cover type map. The one transect in a cleared area had previously been pine plantation and the original plant community was hard to determine.

Table 9 provides species abundance data for canopy, subcanopy, shrub, and groundcover components of relatively unaltered hammocks and hammock altered into pine plantation that is now either cleared or cleared and planted to young pines. Appendix C provides detailed summaries of each condition category.

Table 9. Most abundant species by stratum and community type for hydric oak hammocks and plantation areas that were historically hydric oak hammock.

Species	FloodplainHydric Hammock	FloodplainHydric Hammock Cleared
Overstory (stems/acre, percent of stems)		
Liquidambar styraciflua	26 stems/ac; 11%	29 stems/ac; 42%
Persea borbonia	33 stems/ac; 10%	
Quercus laurifolia	82 stems/ac; 27%	15 stems/ac; 22%
Quercus nigra	34 stems/ac; 10%	8 stems/ac; 11%
Quercus virginiana	51 stems/ac; 17%	
Sabal palmetto	15 stems/ac; 7%	
Ulmus americana		4 stems/ac; 6%

Subcanopy (stems/acre, percent of stems)		
Acer saccharum subsp. *floridanum*	55 stems/ac; 7%	
Carpinus caroliniana	218 stems/ac; 12%	58 stems/ac; 15%
Ilex vomitoria	88 stems/ac; 10%	
Liquidambar styraciflua	53 stems/ac; 6%	89 stems/ac;23%
Persea borbonea	44 stems/ac; 8%	
Quercus laurifolia	92 stems/ac; 12%	62 stems/ac; 16%
Sabal palmetto	54 stems/ac; 7%	
Tilia americana var. *caroliniana*	59 stems/ac; 6%	
Ulmus alata	114 stems/ac; 8%	62 stems/ac; 16%
Ulmus americana		27 stems/ac; 7%
Shrubs (stems/acre, percent of stems)		
Diospyros virginiana		49 stems/ac; 12%
Ilex vomitoria	114 stems/ac; 13%	*
Liquidambar styraciflua		41 stems/ac; 11%
Myrica cerifera	190 stems/ac; 30%	*
Persea borbonea	62 stems/ac; 8%	
Sabal palmetto	520 stems/ac; 43%	274 stems/ac; 70%
Groundcover (percent occurrence, species in 10 percent or more of plots within transect)		
Cyperaceae	23%	
Cyperus sp.	31%	36%
Dichanthelium sp.	14%	36%
Eupatorium capillifolium		12%
Hydrocotyle umbellata		15%
Iris hexagona		14%
Persea borbonea	14%	
Quercus laurifolia	28%	
Rubus argutus	12%	

Sabal palmetto	18%	17%
Smilax bona-nox	64%	14%
Smilax sp.	21%	
Toxicodendron radicans	15%	
Vitis cinerea		27%
Vitis rotundifolia	15%	17%

The observed composition of the natural hydric hammock areas is consistent with description given in Vince et al. 1989. This reference also notes a condition observed in the field during sampling: there is a gradual gradation between hydric hammock as sampled here and the slightly drier mesic hammock, and between these two community types and their more coastal variants.

Table 10. Summary of species occurrence in natural hydric oak hammock hydric oak hammocks that have been converted to pine plantation and then cleared. For restoration/enhancement, the last column provides recommendations for management:

- S – allow succession to take its course
- I – early successional plant, ignore and expect it to disappear as the restoration/enhancement matures
- E – rare or uncommon species to be encouraged
- P – characteristice species that will likely need to be planted to get it into most restoration/enhancement areas
- W – watch and thin if the species becomes overly abundant

	NATURAL	CLEARED	MANAGEMENT RECOMMENDATIONS
Acer rubrum	X	X	S
Acer saccharum subsp. *floridanum*	X		P
Ampelopsis arborea		X	S
Aralia spinosa	X		P
Aristolochia serpentaria	X		P
Asclepias perennis	X		P
Berchemia scandens	X	X	S
Bignonia capreolata	X		P
Botrychium biternatum	X		P
Callicarpa americana	X		P
Campsis radicans	X	X	S
Carpinus caroliniana	X	X	S
Carya aquatica	X		P

	NATURAL	CLEARED	MANAGEMENT RECOMMENDATIONS
Carya glabra	X	X	S
Celtis laevigata	X		P
Centella asiatica	X		S
Cercis canadensis	X	X	S
Chasmanthium laxum	X	X	S
Chionanthus virginicus	X		P
Clematis sp.	X		S
Conoclinium coelestinum	X		S
Cornus foemina	X	X	S
Crataegus sp.	X		P
Crataegus spathulata	X		P
Cyperus sp.	X	X	S
Dichanthelium commutatum	X		S
Dichanthelium sp.	X	X	S
Dichondra carolinensis	X	X	S
Diodia virginiana		X	S
Diospyros virginiana	X	X	S
Elephantopus carolinianus	X		S
Elytraria caroliniensis	X		S
Euonymus americanus	X		P
Eupatorium capillifolium		X	I
Fraxinus americana	X		P
Fraxinus sp.	X	X	S
Hydrocotyle umbellata	X	X	S
Hypericum sp.	X		S
Hyptis alata	X		S
Ilex opaca	X		P
Ilex vomitoria	X	X	S
Iris hexagona		X	I
Juncus sp.	X		I
Juniperus virginiana	X	X	S
Liquidambar styraciflua	X	X	S
Magnolia grandiflora	X	X	S
Magnolia virginiana	X	X	S
Melanthera nivea		X	I
Melothria pendula	X		S
Mikania cordifolia		X	S
Mikania scandens	X		S
Mitchella repens	X	X	S
Myrica cerifera	X	X	S
Oplismenus hirtellus	X	X	S
Ostrya virginiana	X		P
Panicum sp.	X	X	S
Parthenocissus quinquefolia	X	X	S
Paspalum sp.	X	X	S

	NATURAL	CLEARED	MANAGEMENT RECOMMENDATIONS
Persea borbonia	X		P
Persea palustris	X	X	S
Pinus sp.	X		S
Pinus taeda	X	X	S
Ptelea trifoliata	X		P
Quercus laurifolia	X	X	S
Quercus michauxii	X		P
Quercus nigra	X	X	S
Quercus shumardii	X		P
Quercus virginiana	X	X	S
Rhynchospora sp.		X	S
Rubus argutus	X		I
Ruellia caroliniensis	X	X	S
Sabal palmetto	X	X	S
Saccharum baldwinii		X	S
Salvia lyrata	X		I
Scoparia dulcis		X	I
Serenoa repens		X	S
Sideroxylon lanuginosum	X		P
Smilax bona-nox	X	X	W
Smilax smallii	X		S
Smilax sp.	X		S
Solidago odora	X		I
Stachys floridana	X		I
Teucrium canadense		X	I
Thelypteris sp.	X	X	S
Tilia americana var. caroliniana	X	X	S
Toxicodendron radicans	X	X	S
Ulmus alata	X	X	S
Ulmus americana	X	X	S
Viburnum dentatum	X		P
Viburnum obovatum		X	S
Viola sororia	X	X	S
Vitis cinerea	X	X	S
Vitis rotundifolia	X	X	W
Zanthoxylum clava-herculis		X	S

3.4. Rare Species

Most species observed on the TKRLM site are common. However, in the process of conducting the transect sampling, a few occurrences of species listed by the State of Florida were encountered. These locations were mapped using GPS and are presented on Map 6. Also included on the map are a few observations made by ecologists while engaged in wetland delineation or site reconnaissance. No federally listed species were observed.

Several of the species listed occur within limited ranges. *Spigelia loganioides* is endemic to hydric hammocks (Vince et al. 1989) and is fairly characteric of hydric hammocks in north-centeral penninsular Florida. *Phyllanthas liebmannianus* subsp. *platylepis* is endemic to low flatwoods and cleared forests in near-coastal areas of Levy, Taylor, and Dixie counties. *Leitneria floridana* is found in near-coastal wetlands along the Big Bend coastal area from Levy County to Franklin County (Wunderlin and Hansen 2008). *Rudbeckia triloba* occurs on wet distrurbed areas; it is rare in Florida and has a discontinuous distribution (likely associated with heavy soils) but is not endemic. *Lobelia cardinalis* is fairly broad spread through northern Florida; it is not endemic (Wunderlin and Hansen 2008). Allowing natural succession to occur should be appropriate to any species observed, though with time, the two species associated with disturbances (*Rudbeckia triloba* and *Phyllanthus liebmaniaus* subsp. *platylepis* will naturally become more restricted to appearance after natural disturbances to wind- and fire-created openings in the forest.

Under the Preservation of Native Flora of Florida Act (581.185), the sale and transport of state-listed species are regulated. Land owners are not required to protect species if they occur on their property. Land management to encourage the persistence of state-listed plant species on lands slated for preservation or restoration is recommended as part of the mitigation for the proposed mine.

Table 11. Provides a summary of listed plant species known to occur on the TKRLM site and their habitat requirements.

Species	Federal Listing Status	State Listing Status	Plant Communities where Seen
Leitnera floridana	__	T	Natural freshwater wetlands with deep open centers and fairly near the coast
Lobelia cardinalis	__	T	Large moving water wetland
Matelea gonocarpus	__	T	Hammock and cutover hammock
Phyllanthus liebmannianus subsp. *platylepis*	__	E	Hammock and cutover hammock
Rudbeckia triloba	__	E	Widespread in cleared wet areas
Spigelea loganioides	__	E	Mesic/hydric hammock

4. Summary

Overall, the TKRLM site is a highly altered relic of the extensive Gulf Hammock. Based on comparison with the limited pre-silvicultural data, adequate source material for the timbered areas to recover to mesic and hydric hammock is present, and little planting will be required. A limited list of species will benefit (recover substantially more quickly) if some planting is done to provide seed stock. While there is inadequate information to be highly specific, the species which would benefit from planting are those which were observed least frequently in cut over

areas and plantations. A general guide would be to inspect each area proposed for conservation and enhancement, and to plant those species associated with the historic community type that are not observed in at least low abundance.

5. Literature cited

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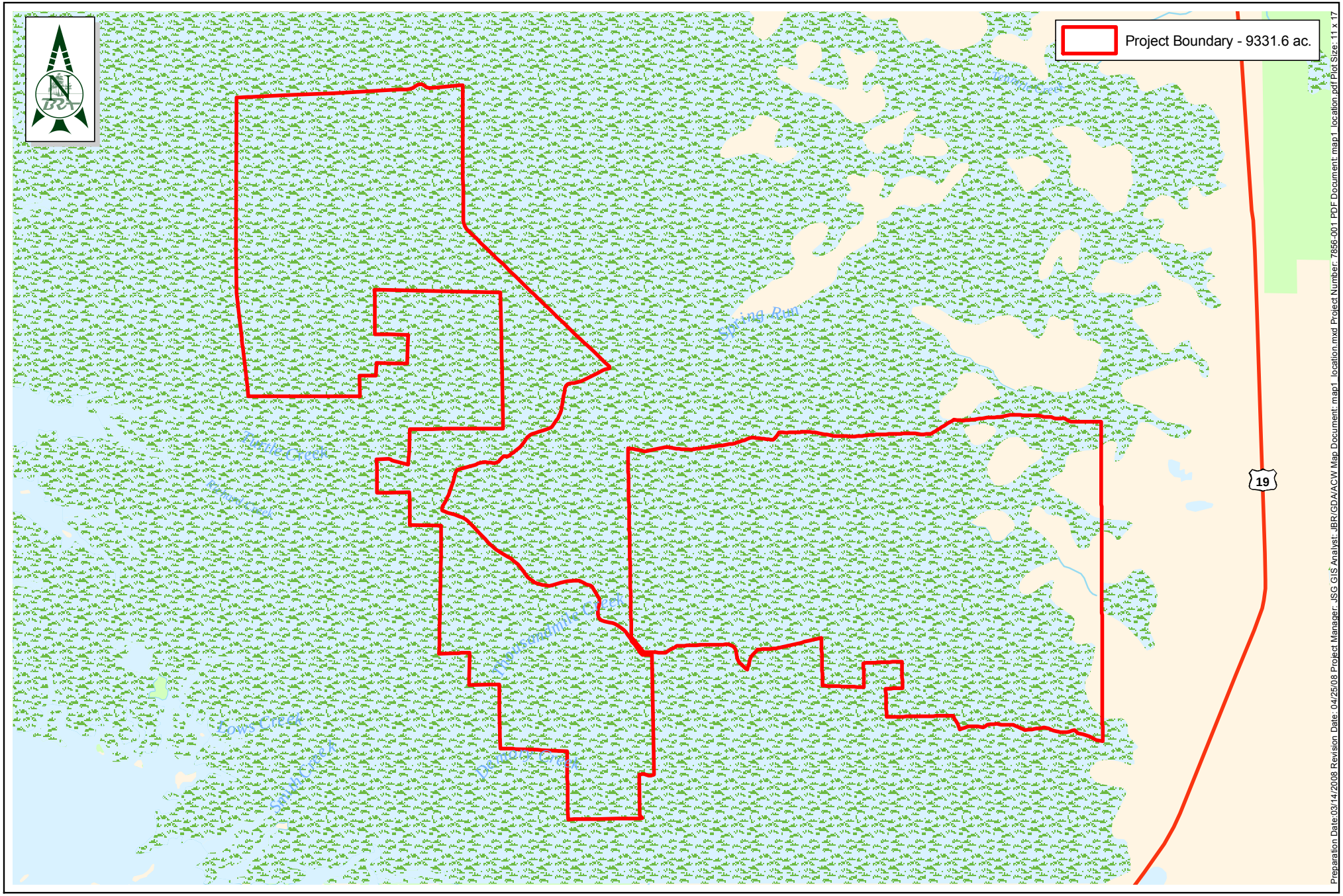

Preparation Date:03/14/2008 Revision Date: 04/25/08 Project Manager: JSG GIS Analyst: JBR/GDA/ACW Map Document: map1_location.mxd Project Number: 7856-001 PDF Document: map1_location.pdf Plot Size: 11 x 17

Feet

0 2,640 5,280 10,560 15,840

Map Scale: 1:63,360

Map 1. Location

Biological Research Associates
a division of ENTRIX
22 Sarasota Center Blvd
Sarasota, Florida 34240
ph 941.378.0660 fx 941.378.0787
www.biologicalresearch.com

Project Boundary - 9331.6 ac.

Map 2. Aerial Photograph

Map Scale: 1:36,000

Biological Research Associates
3905 Crescent Park Drive
Riverview, FL 33578
v. (813) 664-4500
f. (813) 664-0440
www.biologicalresearch.com

Feet
0 1,500 3,000 6,000 9,000

Preparation Date:03/14/2008 Revision Date: 04/25/08 Project Manager: JSG GIS Analyst: JBR/GD/AACW Map Document: map2_aerial.mxd Project Number: 7856-001 PDF Document: map2_aerial.pdf Plot Size: 11 x 17

Project Boundary - 9331.6 ac.

Soils

013 - WEKIVA FINE SAND 1254.5 ac.

025 - PITS AND DUMPS 22.2 ac.

039 - WACCASASSA-DEMORY COMPLEX; FLOODED 6812.8 ac.

041 - DEMORY SANDY CLAY LOAM; OCCASIONALLY FLOODED 954.9 ac.

045 - CRACKER MUCKY CLAY; FREQUENTLY FLOODED 45 ac.

046 - CHOBEE FINE SANDY LOAM; LIMESTONE SUBSTRATUM; FREQUENT 240.4 ac.

099 - WATER < 40 ACRES 2.3 ac.

Feet
0 1,500 3,000 6,000 9,000

Map 3. Soils

Map Scale: 1:36,000

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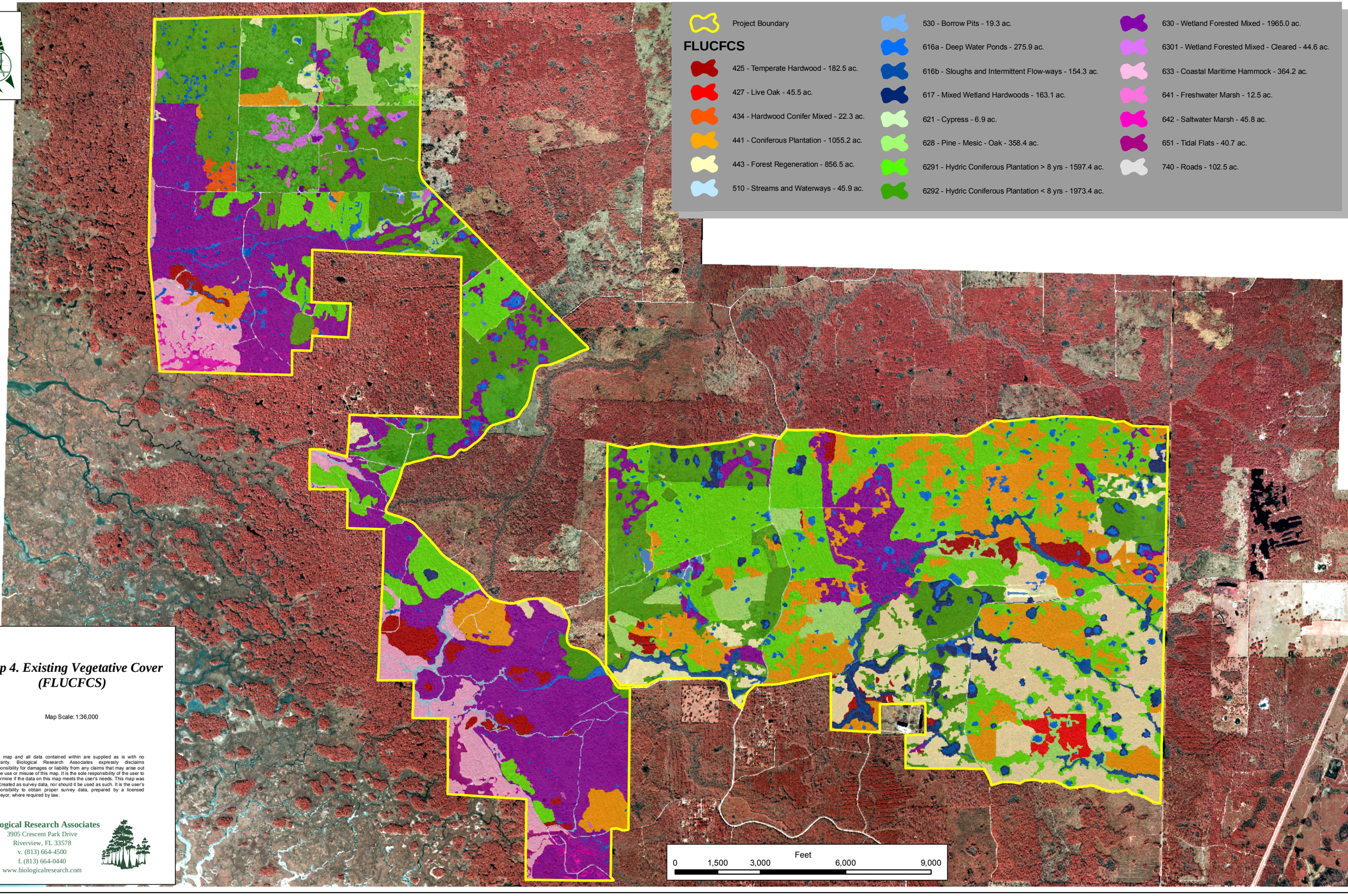
www.biologicalresearch.com

Preparation Date:03/14/2008 Revision Date: 04/25/08 Project Manager: JSG GIS Analyst: JBR/GD/AACW Map Document: map3_soils.mxd Project Number: 7856-001 PDF Document: map3_soils.pdf Plot Size: 11 x 17



Map 4. Existing Vegetative Cover (FLUCFCS)

Map Scale: 1:36,000

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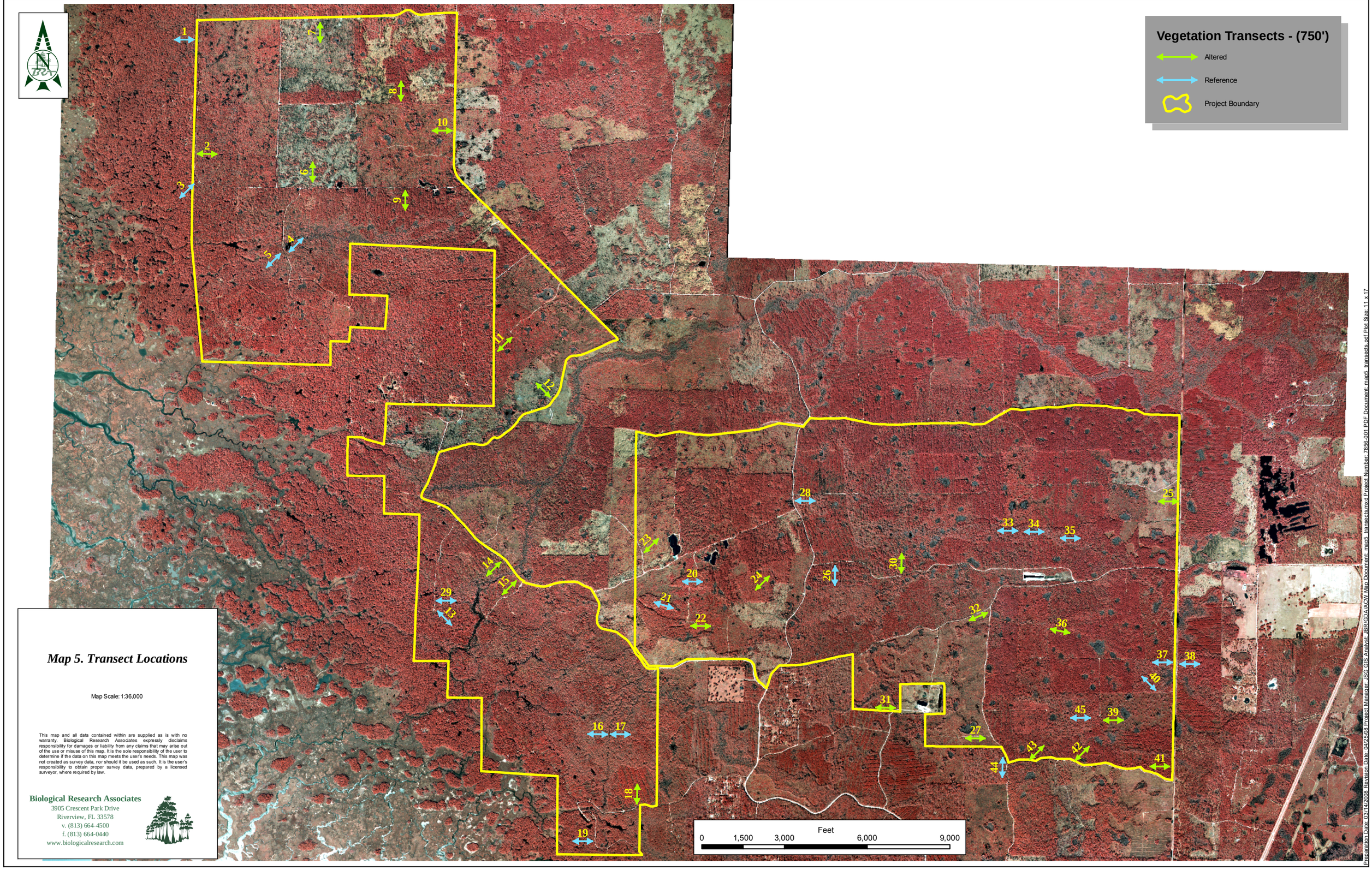
Preparation Date:03/14/2008 Revision Date: 04/25/08 Project Manager: JSG GIS Analyst: JBR/GD/AACV Map Document: map4_veg.mxd Project Number: 7856-001 PDF Document: map4_veg.pdf Plot Size: 11 x 17



Map 5. Transect Locations

Map Scale: 1:36,000

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f. (813) 664-0440
www.biologicalresearch.com

Preparation Date: 03/14/2008 Revision Date: 04/25/08 Project Manager: JSG GIS Analyst: JBR/GDA/ACW Map Document: map5_transects.mxd Project Number: 7856-001 PDF Document: map5_transects.pdf Plot Size: 11 x 17

For Appendix A, "Summary of Species Occurrence by Transect", please refer to the Library at www.kingroadeis.com

ATTACHMENT C – MITIGATION MONITORING PLAN

Monitoring of mitigation efforts is proposed to document the effectiveness of the restoration/enhancement activities, identify and recommend any needed remedial actions, and to measure the progression of the restored/enhanced areas toward meeting the success criteria established for each plant community type (Attachment F) as part of the mitigation plan.

Both qualitative and quantitative monitoring is proposed to occur annually in the late summer/fall for each plant community to be restored or enhanced. Qualitative monitoring provides for documentation of general conditions and provision of needed management recommendations across a large area. Quantitative monitoring provides reproducible sampling of species composition and diversity to track progress of restoration over time. Photographs provide a visual means to track progression over time and to document unique features/circumstances that may not otherwise be captured.

a. Quantitative Monitoring

Quantitative monitoring is provided to document the progress of the restoration/enhancement areas in a manner that is objective, trackable over time, and independent of observer biases. A series of transects will be established in each target plant community. Each transect will be located at a representative site in a major restoration/enhancement area and will be wholly contained within that area. The specific location of each transect locations will be randomized to the greatest extent practicable, via selection of a starting point and a random compass direction within the community with the direction constrained such that the transect remains within the community.

A minimum of 24 quantitative transects will be established throughout the restoration/enhancement areas. The beginning and end points of each transect will be permanently marked and these coordinates recorded by a GPS. Transects will be distributed according to the post restoration/enhancement target communities as indicated below:

Mesic Hammock (421 acres) = 4 transects
Coastal Mesic Hammock (36 acres) = 2 transects
Hydric Hammock (1,865 acres) = 18 transects
Note: all coastal hydric hammock areas are in preservation areas and not in need of restoration/enhancement, hence none need to be sampled

Canopy/Subcanopy Sampling

In natural forests, canopy trees are typically fairly widely spaced and the most efficient means to get species richness and relative dominance are various forms of plotless sampling. In this monitoring protocol, canopy trees will be defined as all species 4 inches (10.2 cm) or more in diameter at “breast height” (DBH - 4.5 feet above the ground). Subcanopy trees will be defined as all species 1 inch (2.5 cm) or more in DBH. Shrubs are defined as those woody plants smaller than sub-canopy/understory trees and greater than 3 feet (1 meter) in height.

Sampling will occur at 50-foot intervals along the transects following the Point- Centered-Quarter methodology. The 50-foot interval may be adjusted upward (by 25 foot) if the resulting selection of species at any interval results in the recounting of individual trees/shrubs. The specific intervals will be determined during the first sampling event and marked (with PVC poles or other

suitable alternative). Each transect will have 25 sample points. At each sample point, the closest canopy two trees in each quadrant determined by the transect line and a line perpendicular to it, will be identified. Likewise, the closest two subcanopy trees, and closest two shrub stems, in each quadrant will be identified. The distance to the closest tree/subcanopy tree/shrub will be measured. For all, the species will be recorded. Individual trees will be marked so that distances will not need to be measured unless an individual moves from one size class to another or dies, resulting in a need to re-tally the individuals in the quadrant.

In addition to the above, above-surface water depth, occurrence of nuisance species, and occurrence of listed species will be recorded if they occur within a 2-m radius of each point.

The following data will be reported based on transect sampling:

Species richness;
Canopy and subcanopy shrub composition based on relative numbers of individuals encountered along the transect; and
Density by species;
Water depths along the transect.

Quantitative monitoring will be initiated prior to management activities to document the baseline condition. Additional monitoring will not occur until the management activities have been initiated including any needed thinning of pines and initial supplemental planting. Once initiated, quantitative monitoring will be conducted in September-October in alternate years.

b. Qualitative Monitoring

The goal of qualitative vegetation monitoring is to provide information useful to management and over a broad area to document success of the restoration and management activities. Areas undergoing active restoration (thinning and initial planting) will be limited to qualitative assessment until the active restoration activities are complete.

A minimum of 24 qualitative transects will be established throughout the restoration/enhancement areas. Transects will be randomly located each monitoring event and will not overlap the quantitative transects to increase coverage and habitat representation. Transects will be distributed according to the post restoration/enhancement target communities as indicated below:

Mesic Hammock (421 acres) = 4 transects
Coastal Mesic Hammock (36 acres) = 2 transects
Hydric Hammock (1,865 acres) = 18 transects
Note: all coastal hydric hammock areas are in preservation areas and not in need of restoration/enhancement, hence none need to be sampled

Qualitative monitoring will be based on 20-minute wandering “transects” covering an area of 20 acres each conducted annually. Each transect will provide photo-documentation and comments on vegetation composition, cover, dominance, recruitment of new species, reproductive status, groundcover composition, hydrologic condition, observations of rare (listed) species, and nuisance species occurrence based on the wandering transect. A GPS track log will be recorded for each qualitative transects. GPS locations will be established for any location needing specific

management including but not limited to observations of breeding locations for federal or Florida-listed endangered or threatened wildlife, occurrence of nuisance species, and recommendations for site-specific management. Photo-documentation will be provided to document any rare species, or areas of unusual conditions that might affect future management (blow-downs from severe storms, fire, etc.). Associated GPS points will be provided for photographs.

The following data will be reported based on qualitative sampling:

Species richness of trees, subcanopy trees, and shrubs;
Rare species occurrences (with GPS points)
Management recommendations (such as pine removal, vine control, etc.)
Nuisance species control recommendations
Notes on disturbances which could affect management needs.
Notes on groundcover composition

c. Photographic Documentation

Vegetative conditions at the quantitatively monitored transects and at representative locations will be documented with photographs. Permanent photo-stations will be established and marked with PVC, rebar, or other appropriate materials. Two photo-stations will be established at strategic locations along each transect, usually at the start and end. An additional ten permanent photo stations will be established at representative spot locations throughout the restoration areas.

At each photo-station, representative and specific field of view photographs will be taken in such a way that they can be replicated during each monitoring event. These photographs will document cover and growth of the restoration areas through comparison of photographs taken from these specific photo stations. Photographs will be taken from a tripod set up to the same specifications each time (height and location) using a cameras set to have the same field of view. The location of transects and photo stations will be shown on the monitoring base map. GPS coordinates will be collected and provided for each photo-station.

d. Reporting

Reporting of qualitative, quantitative and photographic monitoring events will be summarized and submitted annually, no later than December 31 of each year. Monitoring data will be summarized in a tabular-style report for ease of review and comparisons from year to year.

The following data will be summarized, by restoration/enhancement area, in the annual monitoring report:

1. Species richness;
2. Relative dominance/abundance of canopy, subcanopy and shrub species;
3. Density of pines, by species;
4. Simpson's index of diversity (for canopy and subcanopy transect data combined)
5. Water depths along the transects;
6. Observations of wildlife utilization;
7. List of any rare species observed;
8. Photographic documentation;

9. Discussion of nuisance or non-native plant species occurrence and density (with map, as needed);
10. Description of management activities completed since the previous reporting;
11. Overall ecological evaluation of target plant communities; and
12. Recommended remedial actions, if needed.

ATTACHMENT D – PLANT LISTS

Table D-1. Target tree and shrub species abundance based on literature review and on-site sampling for hydric hammocks.

Trees	**Abundance**
Carpinus caroliniana, hornbeam	A
Quercus laurifolia, swamp laurel oak	A
Quercus virginiana, live oak	A
Quercus nigra, water oak	C
Acer rubrum, red maple	C
Acer saccharum subsp. *floridanum*, Florida maple	C
Carya aquatica, water hickory	C
Cornus foemina, swamp dogwood	C
Diospyros virginiana, persimmon	C
Fraxinus americana/F. pennsylvanica, white/green ash	C
Fraxinus caroliniana, pop ash	C
Gleditsia aquatica, water locust	C
Ilex vomitoria, yaupon	C
Juniperus virginiana, red-cedar	C
Liquidambar styraciflua, sweetgum	C
Sabal palmetto, cabbage palm	C
Ulmus alata, winged elm	C
Ulmus americana, American elm	C
Magnolia virginiana, sweet-bay magnolia	O
Tilia caroliniana, basswood	O
Celtis laevigata, sugarberry	O
Ilex cassine, dahoon holly	O
Nyssa sylvatica var. *biflora*, swamp tupelo	O
Acer negundo, box-elder	O
Betula nigra, river birch	O
Carya glabra, pignut hickory	O
Cercis canadensis, redbud	O
Crataegus spp., haw	O
Morus rubra, red mulberry	O
Persea spp., red and swamp bays	O
Pinus taeda, loblolly pine	O
Populus deltoides, poplar, eastern cottonwood	O
Salix caroliniana, coastal plain willow	O
Shrubs	
Myrica cerifera, wax-myrtle	O-C
Baccharis halimifolia, groundsel	O-C
Callicarpa americana, beautyberry	O
Ilex decidua, possum-haw	O
Sabal minor, dwarf palmetto	O
Vaccinium corymbosum, highbush blueberry	O
Viburnum obovatum, Walter's viburnum	O

A – Over 15% of stems
C – 5-15% of stems
O – Less than 5% of stems

Table D-1. Target tree and shrub species abundance based on literature review and on-site sampling for mesic hammocks.

Trees	**Abundance**
Quercus virginiana, live oak	A
Quercus laurifolia, swamp laurel oak	A
Acer saccharum subsp. *floridanum*, Florida maple	C
Carpinus caroliniana, hornbeam	C
Ilex vomitoria, yaupon	C
Juniperus virginiana, red-cedar	C
Liquidambar styraciflua, sweetgum	C
Sabal palmetto, cabbage palm	C
Ulmus alata, winged elm	C
Tilia caroliniana, basswood	O-C
Quercus nigra, water oak	O
Ulmus americana, American elm	O
Carya glabra, pignut hickory	O
Magnolia grandiflora, southern magnolia	O
Fraxinus americana, white ash	O
Cornus foemina, swamp dogwood	O
Celtis laevigata, sugarberry	O
Acer negundo, box-elder	O
Acer rubrum, red maple	O
Betula nigra, river birch	O
Carya aquatica, water hickory	O
Cercis canadensis, redbud	O
Crataegus spp. parsley haw	O
Diospyros virginiana, persimmon	O
Gleditsia aquatica, water locust	O
Ilex cassine, dahoon holly	O
Ilex opaca, American holly	O
Morus rubra, red mulberry	O
Ostrya virginiana, hornbeam, ironwood	O
Persea borbonia., red bay	O
Pinus taeda, loblolly pine	O
Populus deltoides, poplar, eastern cottonwood	O
Quercus shumardii, shumard oak	O
Shrubs	
Serenoa repens, saw palmetto	O-A
Callicarpa americana, beautyberry	O
Baccharis halimifolia, groundsel	O
Lyonia lucida, shiny lyonia	O
Myrica cerifera, wax-myrtle	O
Sabal minor, dwarf palmetto	O
Vaccinium elliottii, mayberry	O
Viburnum obovatum, Walter's viburnum	O

A – Over 15% of stems
C – 5-15% of stems
O – Less than 5% of stems

Table D-1. Tree and shrub species occurring in reference coastal mesic hammocks in the Big Bend region.

Trees	**Abundance**
Quercus virginiana, live oak	A
Sabal palmetto, cabbage palm	A
Quercus laurifolia, swamp laurel oak	A
Acer saccharum subsp. *floridanum*, Florida maple	C
Carpinus caroliniana, hornbeam	C
Ilex vomitoria, yaupon	C
Juniperus virginiana, red-cedar	C
Liquidambar styraciflua, sweetgum	C
Ulmus alata, winged elm	C
Magnolia grandiflora, southern magnolia	O
Carya glabra, pignut hickory	O
Tilia caroliniana, basswood	O
Cornus foemina, swamp dogwood	O
Fraxinus americana	O
Ulmus americana, American elm	O
Acer negundo, box-elder	O
Acer rubrum, red maple	O
Betula nigra, river birch	O
Celtis laevigata, sugarberry	O
Cercis canadensis, redbud	O
Crataegus spp., haw	O
Diospyros virginiana, persimmon	O
Morus rubra, red mulberry	O
Ostrya virginiana, hornbeam, ironwood	O
Persea borbonea., red bay	O
Pinus taeda, loblolly pine	O
Populus deltoides, poplar	O
Quercus nigra, water oak	O
Quercus shumardii, shumard oak	O
Shrubs	
Serenoa repens, saw palmetto	O-A
Myrica cerifera, wax-myrtle	O
Baccharis halimifolia, groundsel	O
Callicarpa americana, beautyberry	O
Lyonia lucida, shiny lyonia	O
Sabal minor, dwarf palmetto	O
Vaccinium elliottii, mayberry	O
Viburnum obovatum, Walter's viburnum	O

A – Over 15% of stems
C – 5-15% of stems
O – Less than 5% of stems

ATTACHMENT E – EXOTIC AND NUISANCE SPECIES CONTROL PLAN

The Tarmac King Road Limestone Mine mitigation site includes both relatively natural and altered plant communities. Alterations to native plant communities including establishment of conifer plantations and harvesting of both conifers and hardwoods throughout the mitigation site have allowed for the encroachment of nuisance and/or exotic species in limited areas. Six general areas have been mapped as including three species of concern (Figure DEP 32-1). Three species observed on site, air potato (*Dioscorea bulbifera*), Japanese honeysuckle (*Lonicera japonica*) and cogongrass (*Imperata cylindrical*) are identified as Category 1 invasive exotics according to the Florida Exotic Pest Plant Council's (FLEPPC) 2009 List of Invasive Plant Species. Cattail (*Typha spp.*), although a native to Florida, can become a nuisance species where land alterations have occurred. Restoration of native habitats will include the control and eradication of these targeted species as well as others as identified FLEPPC 2009 List of Invasive Plant Species, should they be identified during future restoration and monitoring activities. Additionally, any nuisance species, particularly vines such as *Vitis* spp., *Smilax* spp., *Rubus* spp., and *Mykania scandens* that occur in densities such that they impede the survival of the mitigation target community species will be removed.

All areas containing exotic and nuisance species will be mapped in Year 1 and chemically treated to control and eventually eradicate these species from the mitigation sites.

CATTAILS

Cattails, generally limited to the existing excavated open water areas, will be controlled through the application of herbicides such as Rodeo during the active growing season. Subsequent assessments and applications of herbicides will be conducted as needed to ensure control.

AIR POTATO

Air potato will be treated with an appropriately labeled herbicide such as 2-4D and may be mechanically or manually pulled from the tree canopies. Subsequent applications during the earlier part of the growing season will be conducted as needed to ensure control of regrowth as well as sprouting from bulbs.

COGONGRASS

Cogongrass, an aggressive, invasive species, has become established in a number of locations throughout the mitigation site as a result of previous ground disturbing activities. Control of cogongrass will occur by either burning or mowing the existing patches of cogongrass to reduce the amount of thatch. Following the mowing or burning activity, herbicides such as Roundup and/or Arsenal will be applied once re-sprouts have reached approximately 12" in height in order to maximize up-take of herbicides into the rhizomes. Alternately, discing and/or tilling of the soil to a depth of 6" may occur in order to break up the rhizomes to facilitate control. A re-treatment of herbicide will be undertaken at least one month prior to the on-set of the first frost in order to weaken the plants during the winter, if necessary. Annual assessments with follow-up herbicide applications will be conducted as needed to ensure effectiveness of treatments and ultimate control of cogongrass throughout the mitigation site. Once control of cogongrass has been achieved, these areas will be replanted with native groundcover if necessary in an effort to preclude the re-establishment of cogongrass and facilitate the establishment of desirable native species.

JAPANESE HONEYSUCKLE

Japanese honeysuckle was only observed at a few locations on the property and will be treated with an appropriately labeled herbicide such as 2-4D.

All applications of herbicide treatments will be conducted with coordination of the Qualified Mitigation Supervisor (QMS) and supervised or conducted by herbicide applicators licensed by the State of Florida.

The following success criteria are proposed for the control of nuisance and exotic plant species:

Cover of Category I and II Invasive Exotic Plant Species, pursuant to the most recent current list established by the Florida Exotic Pest Plant Council at http://www.fleppc.org, and the nuisance species primrose willow (*Ludwigia peruviana*) and cattail (*Typha* sp.) shall be controlled by herbicide, fire, hydrological or mechanical means. The cover of nuisance species shall be less than 10% in all mitigation areas and the cover of exotic species shall be less than 5% in all mitigation areas. This program shall include at least semi-annual inspections of wetlands and other surface waters for nuisance species. In addition, annually the permittee shall make every attempt to control cogongrass (*Imperata cylindrica*) within the remainder of the project area by eradicating existing cogongrass prior to mining, removing cogongrass that may colonize spoil piles during mining, inspecting donor top soil areas to prevent infestation, regularly treating cogongrass on reclaimed upland sites to below 10% and below 5% within 300 feet of preserved wetlands, and treating equipment that may have been operated in infested areas prior to being brought onsite .

ATTACHMENT F – SUCCESS CRITERIA

Final Success. The overall goals of the mitigation effort are to eliminate artificial drainage, extend hydroperiods, preserve and maintain existing intact wetlands and uplands, enhance harvested wetland and upland forests with supplemental planting, and convert planted pine communities to the appropriate native hammock community type. Existing conditions are shown in Figure 2-6, mitigation activities are described in Section 4, hydrologic activities are depicted in Attachment H, and proposed communities are shown in Figure 3-2.

Mitigation shall be deemed successful when all of the following criteria, in addition to the community descriptions in Attachment B, have been met for a period of at least one full year without intervention in the form of eradication of undesirable vegetation, pine harvesting, or replanting of desirable vegetation. A list of regionally desirable plants species per proposed community type is provided in Attachment D-1. Some species not found within the reference sites may be determined to be desirable for the purpose of this condition by providing a citation and/or third party professional botanist/ecologist. Species may be added or removed from this list based on reference site data.

a. Entire Site.
   1. Plants are reproducing naturally, either by normal, healthy vegetative spread (in ways that would be normal for each species) or through seedling establishment, growth, and survival;
   2. All wetland target communities proposed for enhancement (see Figure 3-2) shall meet wetland delineation criteria as defined by 62-340, FAC;
   3. Coverage by category I and II invasive exotic plant species (pursuant to the most current list established by the Florida Exotic Pest Council at www.fleppc.org) shall not exceed 5% total coverage per acre;
   4. Vegetation in each target community is dominated by species indicative of the target/historic community assemblage, as described in Attachment B.

b. Overall Hydrology.
   1. All low water crossing installations, culvert replacements, and ditch fill areas (see Attachment G) have been completed to the satisfaction of FDEP, are stabilized showing no signs of erosion, and have operated as designed without repair for a period of two years;
   2. There is no evidence of wash outs, erosion, or other indications of unnatural channelized water flow;
   3. Each wetland polygon associated with crossing enhancements (see Attachment G) shall demonstrate appropriate hydric soils per Rule 62-340, F.A.C.

c. Upland and Wetland Enhancement Areas
   1. All areas proposed for enhancement in Figure 3-2 shall have at least 300 tree stems per acre and 200 shrub stems per acre that are considered representative of the target community type.
   2. At least 80% of the tree and shrubs species known from the target community types (Table D-1) are present in the enhanced and restored communities. These representative species must be capable of successful reproduction and colonizing the remainder of the plant community type.

d. UMAM Assessment. Using monitoring data and reports, and in conjunction with the

permittee, the Department shall inspect the site and conduct a UMAM analysis to ensure that all communities in the enhancement areas have reached, or are expected to reach and maintain, the "with mitigation" scores in Figure 5-2 areas or community descriptions in Attachment B under the permitted management requirements.

Tarmac King Road Limestone Mine

Mitigation Parcel Hydrologic Enhancement Plan

Levy County, Florida

FEBRUARY 2010

SUBMITTED TO:

Florida Department of Environmental Protection
Bureau of Mine Reclamation
2051 East Dirac Street
Tallahassee, FL 32310

PREPARED BY

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SECTION 1

Introduction

This Tarmac King Road Limestone Mine: Mitigation Parcel Hydrologic Enhancement Plan serves as supplemental information for the Tarmac King Road Limestone Mine Mitigation Plan (revised February 2010), specific to proposed hydrologic improvements to the site.

The objective of this plan is to restore the historic sheet flow across the TMS to a more natural state by evaluating current conditions, identifying any areas that can be improved, and suggesting a strategic plan for implementing improvements to the overall hydrology of the site while insuring the proposed changes do not cause any adverse affects to adjacent landowners.

The Tarmac King Road Limestone Mine Project (the Project) has established a proposed mitigation site located adjacent to the mine parcel and within the Gulf Hammock Wildlife Management Area (GHWMA) in Levy County, Florida (Figure 1). The referenced mitigation site, known as TMS, is comprised of approximately 4,526 acres of commercial timberland that is owned and managed by Plum Creek Timber Company. The TMS is proposed for use as a mitigation parcel to offset wetland impacts associated with proposed mining operations. Tarmac's mitigation goal is to return the TMS to historic Gulf Hammock mixed hardwood mosaics that existed prior to the site's conversion to timberland. Two historic aerial photographs (Figures 2 & 3) are included in this report from years 1970 and 1963, respectively, as references for the site's condition prior to significant alternations, including the installation of systems of roads, ditches and culverts.

1.1 LOCATION

The TMS is located in Sections 6, 7, 11,12,13,17 thru 20, and 29, Township 16 South, Range 16 East; Sections 1, 2 and 31, Township 16 South, Range 15 East; and Sections 25, 26, 35 and 36, Township 15 South, Range 15 East in Levy County, Florida (Figure 4). More specifically, it is located north of Inglis, between US19 and the Gulf of Mexico. It is contiguous to the Waccasassa Bay State Preserve and lies entirely within the 25,655-acre GHWMA, which is listed for acquisition by the Florida Forever program. Other conservation lands that are located nearby include Goethe State Forest to the east, Cedar Key Scrub State Reserve and the Lower Suwannee National Wildlife Refuge to the north, and the Waccasassa Bay State Preserve to the west (Figure 5).

SECTION 2

Existing Hydrologic Conditions

Surface water flows from east to west across the TMS and into Waccasassa Bay. The TMS has significant hydrologic connectivity with Waccasassa Bay and the Gulf of Mexico, as well as a hydrologic corridor through the eastern end of the Spring Run system. The current hydrology of the TMS has been affected by ongoing logging activities and the installation of systems of roads, ditches, and culverts throughout the site. These activities have, respectively, impounded water upstream of crossings, altered sheet flow in the hammocks and drained remaining wetlands.

Field work for the Hydrological Enhancement Plan was conducted on 2, 16, 18, & 28 December 2009 and its purpose was to investigate current hydrologic conditions on-site, and to evaluate any potential areas for improvements; including current ditch locations with analysis and measurements, locations of existing ditch blocks, and also known culverts as to their condition and functionality. The Hydrologic Improvement Evaluation Survey Transects Map (Figure 6) shows the on-site area covered by ENTRIX personnel during these investigations.

2.1 CULVERTS

During site investigations, twenty-seven known culverts were inspected as to their current condition and functionality (Figure 7). All observations were recorded, including classification of culverts as functional or non-functional.

Based on surveys, fourteen culverts on-site were classified as functional. Approximately one half of the culverts in this classification were located in the southern portion of the TMS, with the remaining functional culverts scattered throughout the site. Some of the functional culverts appear to have been recently replaced.

Thirteen culverts are classified as non-functional for various reasons. A majority of these culverts are located along the eastern boundary, or Buckhead Road. These previously documented culverts could not be located in the field, and are likely buried as a result of the windening of Buckhead Road for logging activities. In addition to being buried, these culverts are likely crushed, damaged and/or blocked by debris, and are not long enough to bisect the road post-widening; no longer providing hydrologic connectivity across the road. This impacts the overall hydrology of the TMS by limiting flow from the east onto the TMS. The field notes and photographs documenting the condition of existing culverts is included as Appendix A.

2.2 DITCHES

During site investigations, the TMS was canvassed for any ditching along roads that may be affecting surface flow. Once the ditches were located in the field, transects were established across them. Transect locations were recorded using a sub-meter accuracy GPS unit. Information was recorded on ditch features, including height and width measurements. Brief vegetation descriptions were recorded for each transect. Forty-nine total transects were established throughout the TMS, and locations are represented by numbered points on an aerial photograph, 3-part exhibit (Figures 8, 9, and 10) Measurements associated with each specific point can be referenced in Appendix B, which also contains representative photos of each ditch and the field notes recorded.

Ditching is observed heavily in the northern portion of the TMS; with forty-three of the total forty-nine transects established in this area. This is a result of the number of installed roads added to this specific area, and the prominent clearing activities that take place. In this referenced area, existing ditches are affecting the hydrology of the site by draining wetlands and essentially capturing water and conveying it away from the TMS.

2.3 DITCH BLOCKS

While investigating the TMS for potential improvements, any observed ditch blocks were evaluated as to their function and effect on the hydrology of the site. A total of thirty-four ditch blocks were recorded, and points are represented on Figures 8 -10. The blocks range from functioning operational roads which block the ditch, to remnants of old roads or staging lay-down areas for logging activities which effectively create a block.

Areas adjacent to these blocks were investigated, both in the field and by reviewing aerial photographs, to make conclusions as to where water was being directed to, or being contained by the block. Currently, the majority of the ditch blocks are located in the northern portion of the TMS. The existing blocks seem to be functioning by retaining water on-site and redirecting it into adjacent wetlands. This, in turn, helps to maintain a more natural

hydroperiod. The field notes and photographs documenting the condition of existing ditch blocks is included as Appendix C.

SECTION 3

Proposed Improvements

Based on all of the information gathered during site investigations, the following hydrologic improvements are proposed on the TMS. These efforts will restore a more historic and natural sheet flow across the site and will provide more natural hydroperiods in the existing wetlands.

3.1 CULVERTS

Thirteen of the culverts observed on-site were classified as buried, crushed, damaged, and/or blocked by debris, and are therefore non-functional. This is limiting water access onto the site from the east across Buckhead Road, restricting the historic sheet flow. Twelve of the non-functional culverts will be replaced with mitered, concrete-capped culverts (Figure 11). This will release impounded water on the east side of Buckhead Road and grant the movement of water across the site; resulting in improved hydrology and restoration of historic surface water flow throughout. This is important for the proposed mitigation because all other proposed improvements within the TMS boundary will benefit from improved hydrologic connections.

3.2 DITCH BLOCKS

The site was canvassed for any ditches occurring along roads that could be draining water from wetlands and disrupting the natural hydrologic connectivity across the site, or expediently draining water off of the site. Adding ditch blocks to strategic locations in order to slow drainage in the ditches would extend on-site surface water retention times and benefit the overall hydrology of the site. A total of fifteen proposed ditch blocks, located mainly in the northern portion of the mitigation site, are proposed. The expectation is that these ditch blocks will result in water being maintained on-site and will function to redirect and retain water in wetlands that are currently being drained by ditches. Figure 11 provides the locations of all existing and proposed ditch blocks.

3.3 LOW WATER CROSSINGS

Two low water crossings (LWC) are proposed for the TMS. The first is located in the mid-section and will replace a non-functional culvert. This installation will permit the free flow of seasonal high water across the existing road, which will function in promoting better connectivity throughout the slough system; essentially allowing the water from the east through the system, to Waccasassa Bay, and finally out to the Gulf of Mexico. The second proposed LWC is also located on a north/south road in the mid-section of the site. The proposed crossing will provide the same function as referenced above and will permit the flow of seasonal high water across the road, from east to west, inturn providing hydrologic connectivity through the wetland systems in this area. Figure 11 provides the locations of the proposed low water crossings.

SECTION 4 Conclusion

The goal of this plan is to restore historic sheet flow and restore hydrology on the TMS back to a more natural state; reminiscent of the site's condition before systems of roads, ditches, and culverts were installed to support logging activities. Currently, on-site conditions exist that have been limiting the hydrology on the TMS. Proposed improvement activities include ditch blocks in strategic locations, installations of low water crossings, and culvert repairs. One of the main obstacles facing the TMS is restoring the connection for the historic sheet flow from the eastern adjacent land areas. This is a major component in the hydrological restoration plans of the TMS. The replacement of the non-functioning culverts will allow water to from the east reach the TMS. With the installations of additional ditch blocks and low water crossings, along with the repairs to non-functional culverts, a significant improvement in overall site hydrology will be observed over time.

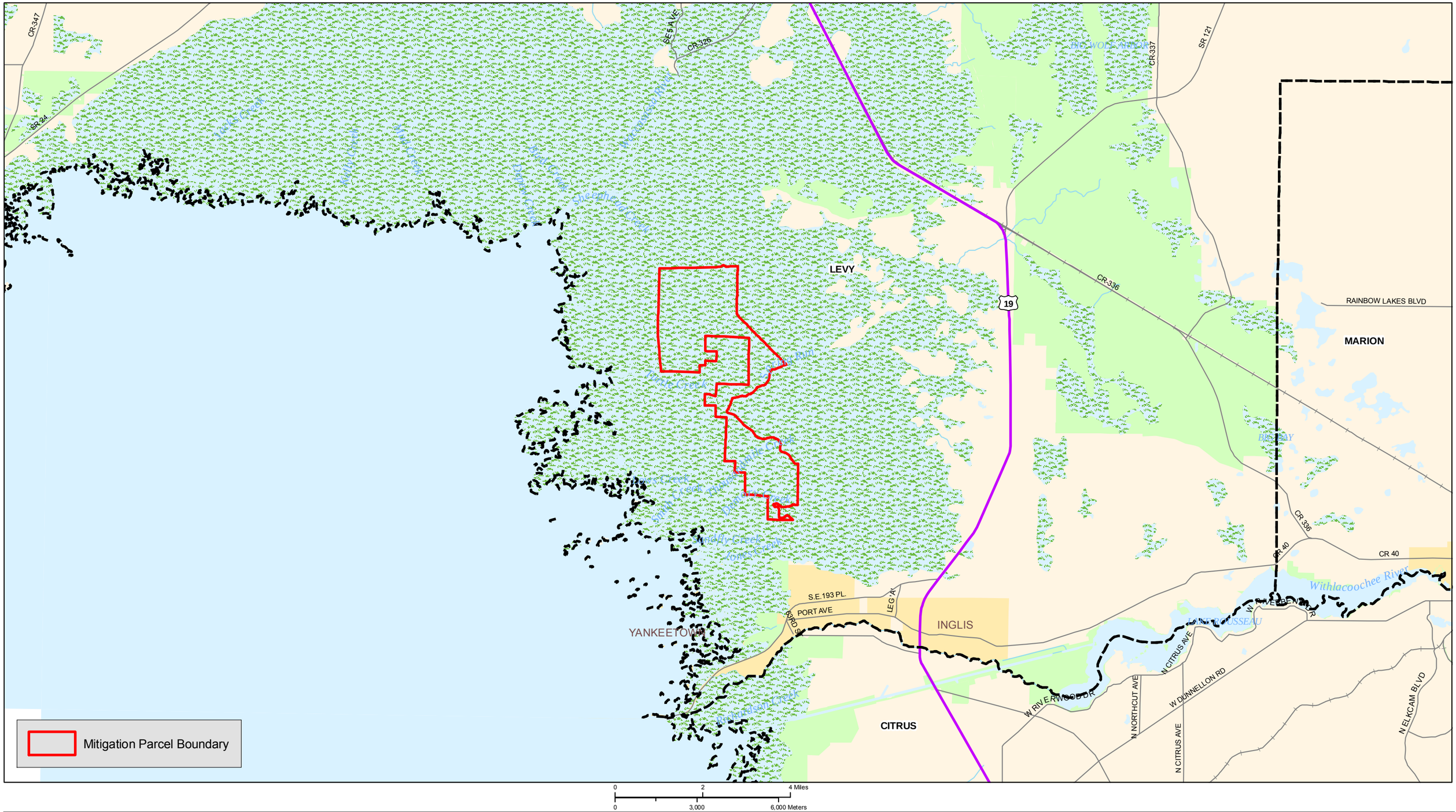

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Figure 1.
Location Map

Tarmac King Road Limestone Mine
Mitigation Parcel
Levy County, Florida

Image:Base

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Coordinate System:
NAD 1983 UTM Zone 10N feet

Date: 01/21/10Rev. Date: 02/02/2010 PM: MEE GIS Analyst: MAB Map Document: Fig2_loc_A_mab_20100121.mxd Project Number: 7856-001 PDF Document: loc_A_mab_20100202.pdf Plot Size: 11 x 17

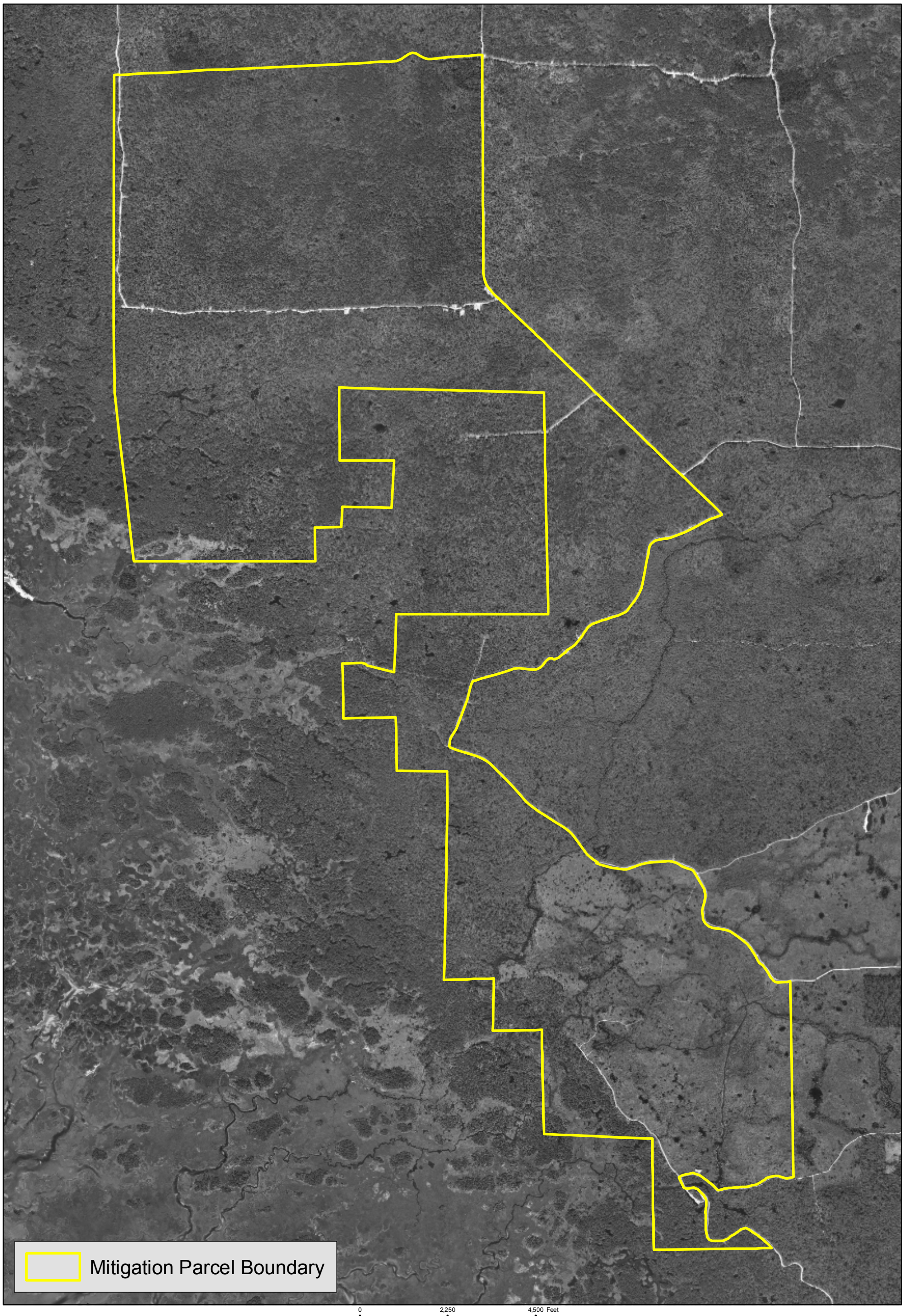

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Figure 2.
1970 Historic Aerial

Tarmac King Road Limestone Mine
Mitigation Parcel
Levy County, Florida

Image: 1970

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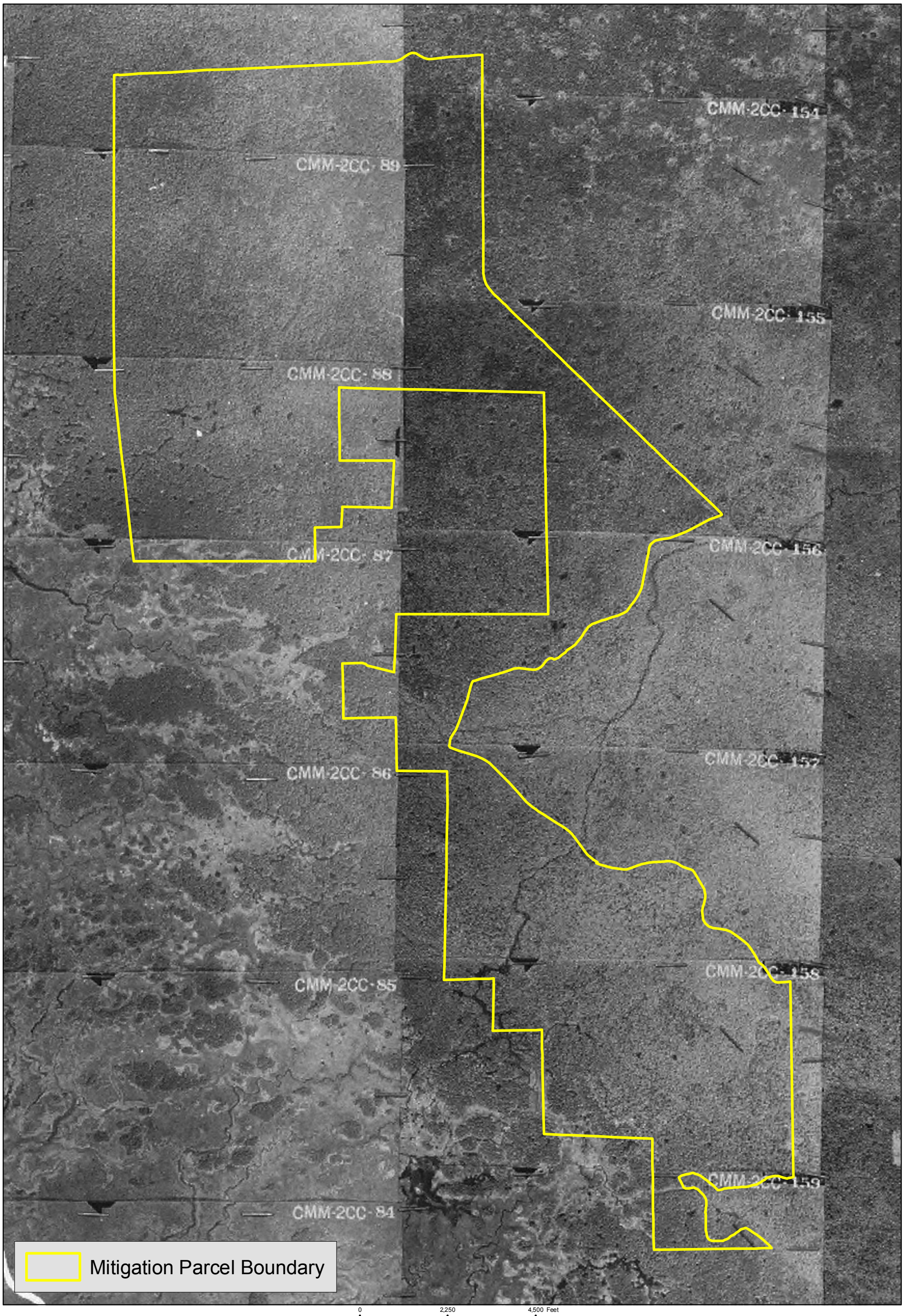
Coordinate System:
Albers

Date: 01/20/2010 Rev. Date: 02/02/2010 PM: MEE GIS Analyst: GdA Map Document: 1970_mitigation_B_gda_20100120.mxd Project Number: 7856-001 PDF Document: 1970_mitigation_B_gda_20100202.pdf Plot Size: 11 x 17



0 2,250 4,500 Feet

0 590 1,180 Meters

Figure 3.
1963 Historic Aerial

Tarmac King Road Limestone Mine
Mitigation Parcel
Levy County, Florida

Image: 1963

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Mitigation Parcel Boundary

0 3,000 6,000 Feet
0 880 1,760 Meters

Figure 4.
USGS Quadrangle Map

Tarmac King Road Limestone Mine
Mitigation Parcel
Levy County, Florida

Image:USGS Quad:
Lebanon Station
Waccasassa Bay
Yankeetown
Withlacoochee Bay

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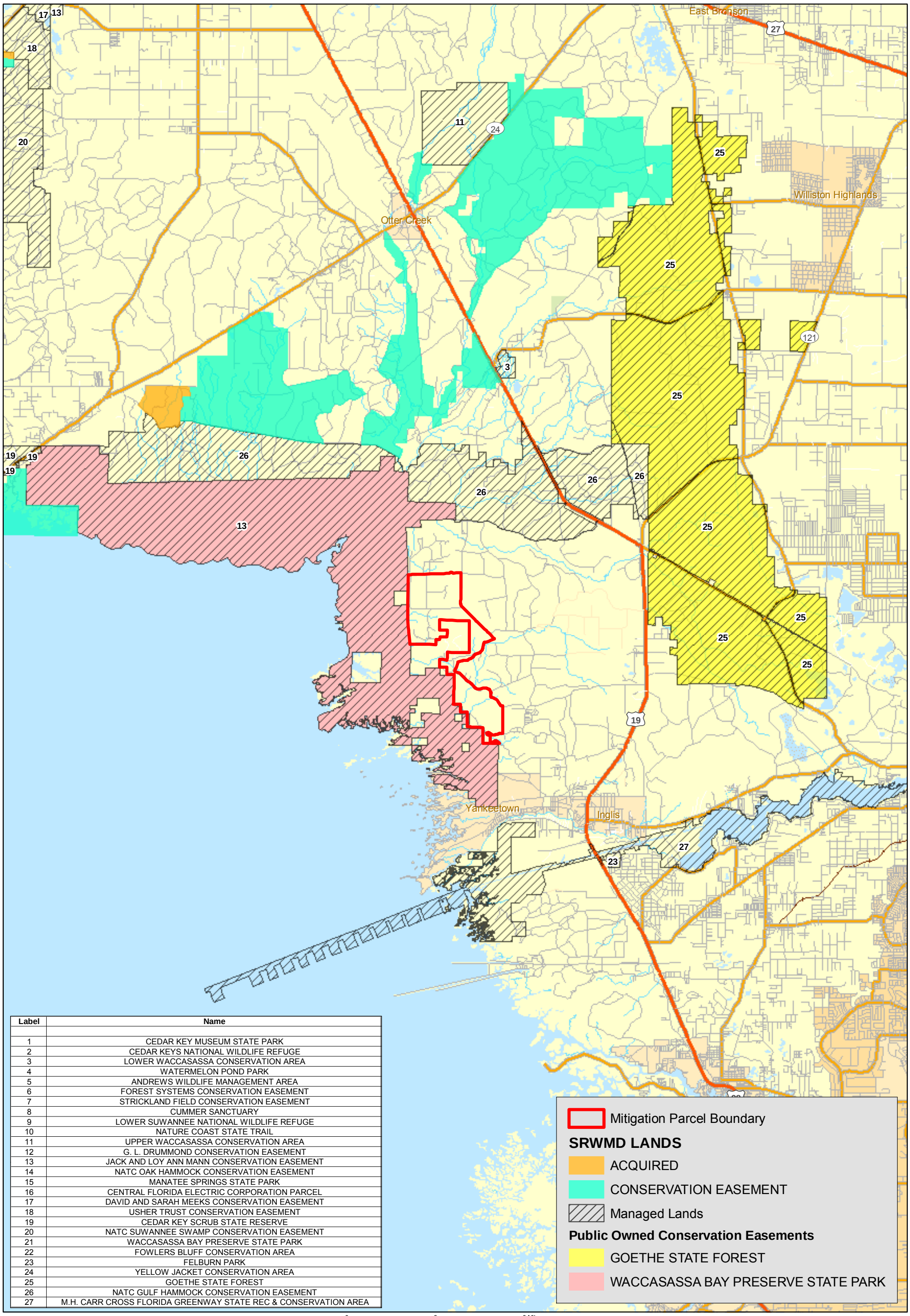
Coordinate System:
NAD 1983 UTM Zone 10N feet

Date: 02/02/2010 Rev. Date: n/a PM: MEE GIS Analyst: GdA Map Document: quad_mit_B_gda_20100202.mxd Project Number: 7856-001 PDF Document: quad_mit_B_gda_20100202.pdf Plot Size: 11 x 17



Label	Name
1	CEDAR KEY MUSEUM STATE PARK
2	CEDAR KEYS NATIONAL WILDLIFE REFUGE
3	LOWER WACCASASSA CONSERVATION AREA
4	WATERMELON POND PARK
5	ANDREWS WILDLIFE MANAGEMENT AREA
6	FOREST SYSTEMS CONSERVATION EASEMENT
7	STRICKLAND FIELD CONSERVATION EASEMENT
8	CUMMER SANCTUARY
9	LOWER SUWANNEE NATIONAL WILDLIFE REFUGE
10	NATURE COAST STATE TRAIL
11	UPPER WACCASASSA CONSERVATION AREA
12	G. L. DRUMMOND CONSERVATION EASEMENT
13	JACK AND LOY ANN MANN CONSERVATION EASEMENT
14	NATC OAK HAMMOCK CONSERVATION EASEMENT
15	MANATEE SPRINGS STATE PARK
16	CENTRAL FLORIDA ELECTRIC CORPORATION PARCEL
17	DAVID AND SARAH MEEKS CONSERVATION EASEMENT
18	USHER TRUST CONSERVATION EASEMENT
19	CEDAR KEY SCRUB STATE RESERVE
20	NATC SUWANNEE SWAMP CONSERVATION EASEMENT
21	WACCASASSA BAY PRESERVE STATE PARK
22	FOWLERS BLUFF CONSERVATION AREA
23	FELBURN PARK
24	YELLOW JACKET CONSERVATION AREA
25	GOETHE STATE FOREST
26	NATC GULF HAMMOCK CONSERVATION EASEMENT
27	M.H. CARR CROSS FLORIDA GREENWAY STATE REC & CONSERVATION AREA

Figure 5.
Conservation Lands Location Map

Tarmac King Road Limestone Mine
Mitigation Parcel
Levy County, Florida

Image:Base

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Date: 02/02/2010 Rev. Date: n/a PM: MEE GIS Analyst: GdA Map Document: conservation_lands_loc_B_gda_20100202.mxd Project Number: 7856-001 PDF Document: conservation_lands_loc_B_gda_20100202.pdf Plot Size: 11 x 17

Mitigation Parcel Boundary

Survey Trasnects

0 2,250 4,500 Feet

0 590 1,180 Meters

Figure 6.
Hydrologic Improvement Evaluation Survey Transects Map

Tarmac King Road Limestone Mine
Mitigation Parcel
Levy County, Florida

Image: 2007 IR

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Coordinate System:
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Date: 12/31/09 Rev. Date: 02/02/2010 PM: MEE GIS Analyst: GdA Map Document: hydro_improve_trans_B_gda_20091231.mxd Project Number: 7856-001 PDF Document: hydro_improve_trans_B_gda_20100202.pdf Plot Size: 11 x 17

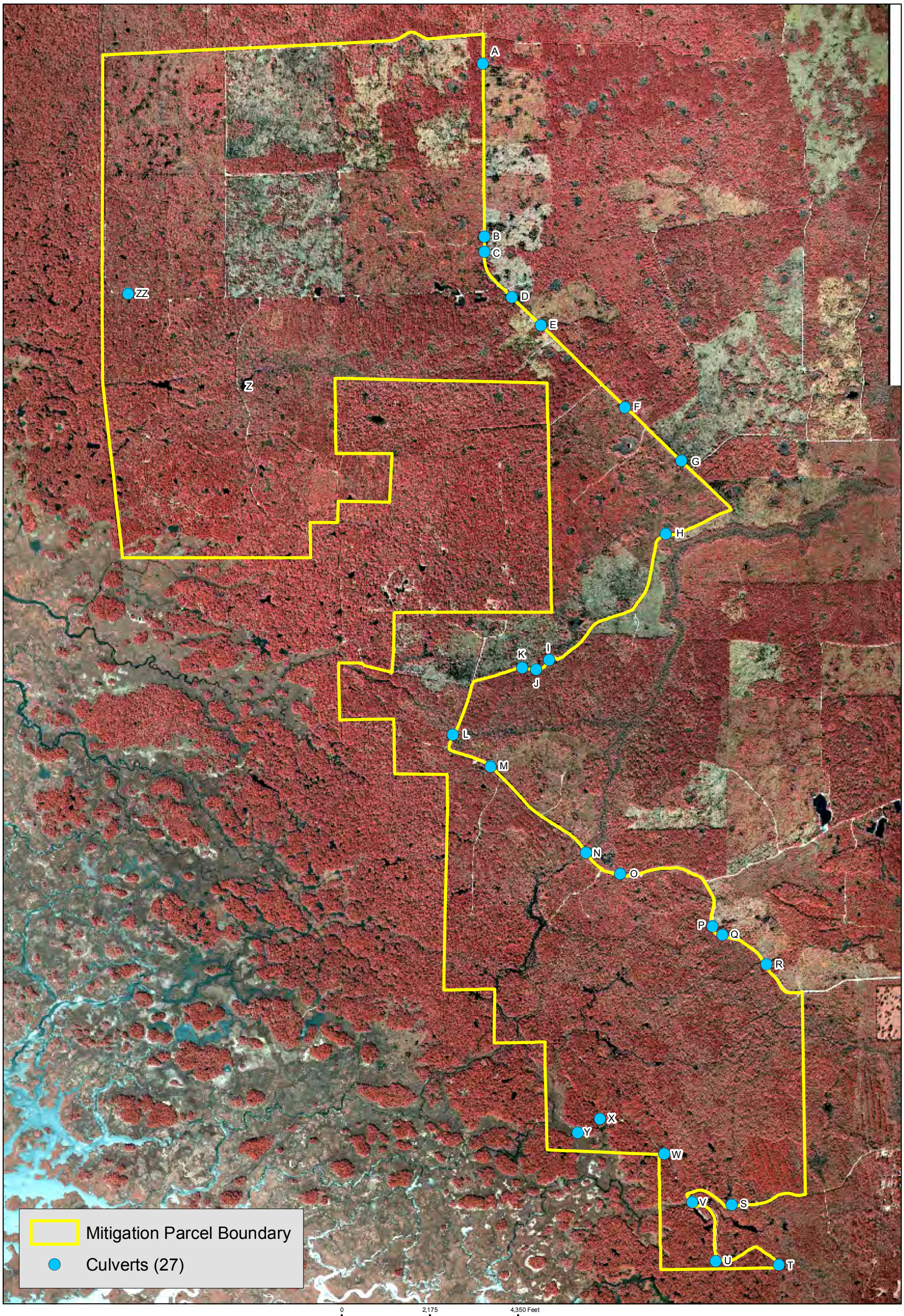

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Figure 7.
Culvert Locations Map

Tarmac King Road Limestone Mine
Mitigation Parcel
Levy County, FL

Image:2007 IR

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Coordinate System:
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Date: 11/18/09 Rev. Date: 02/02/2010 PM: MEE GIS Analyst: GdA Map Document: culverts_B_gda_20091120.mxd Project Number: 7856-001 PDF Document: culverts_B_gda_20100202.pdf Plot Size: 11 x 17

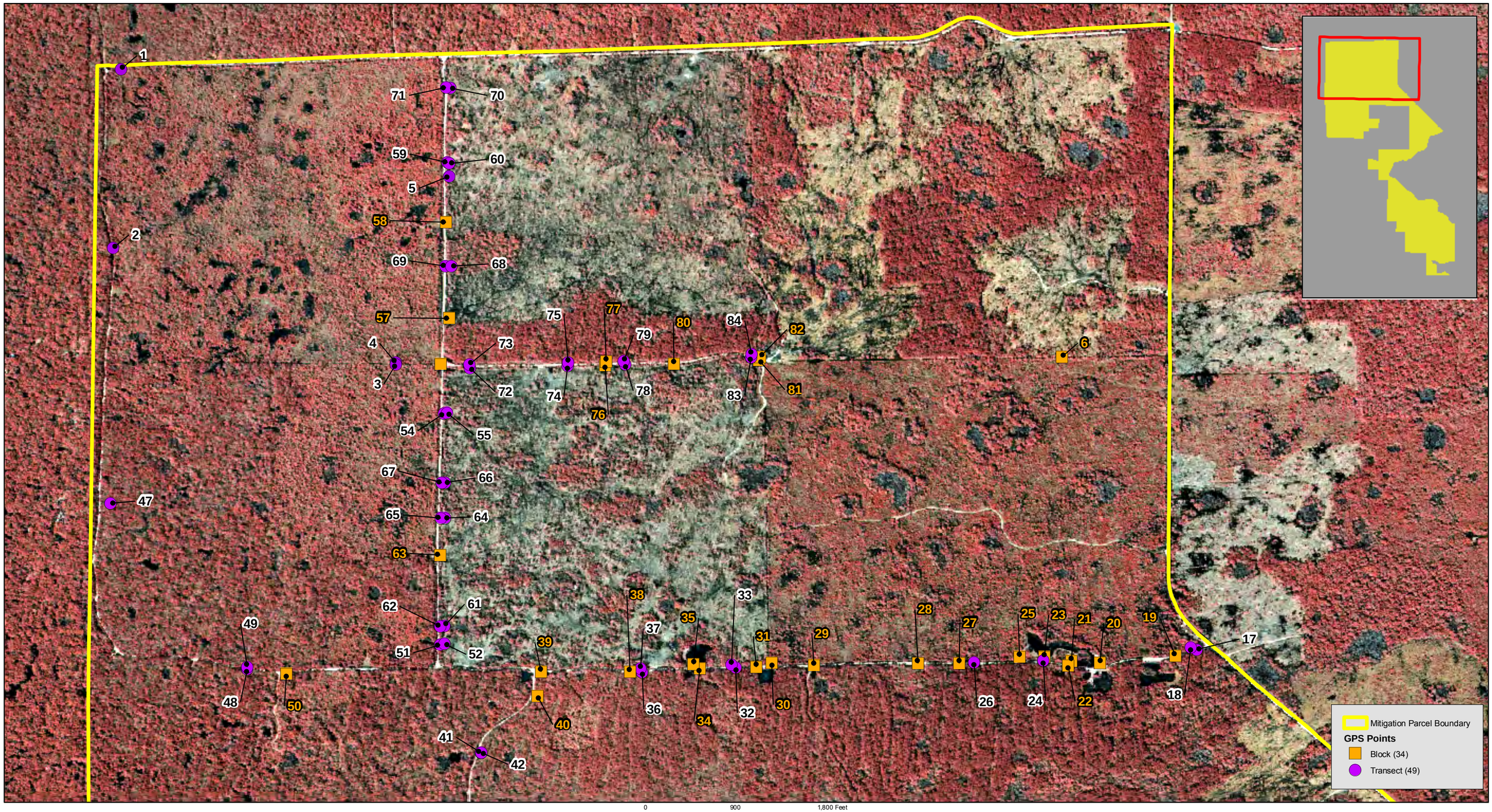

Figure 8.
Hydrologic Improvement Evaluation Locations Map

Tarmac King Road Limestone Mine
Mitigation Parcel
Levy County, Florida

Image:2007IR

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Coordinate System:
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Date: 12/21/09 Rev. Date: 02/02/2010 PM: MEE GIS Analyst: GdA Map Document: hydro_improve_mit-north_GPS_B_gda_20100106.mxd Project Number: 7856-001 PDF Document: hydro_improve_mit-north_GPS_B_gda_20100202.pdf Plot Size: 11 x 17

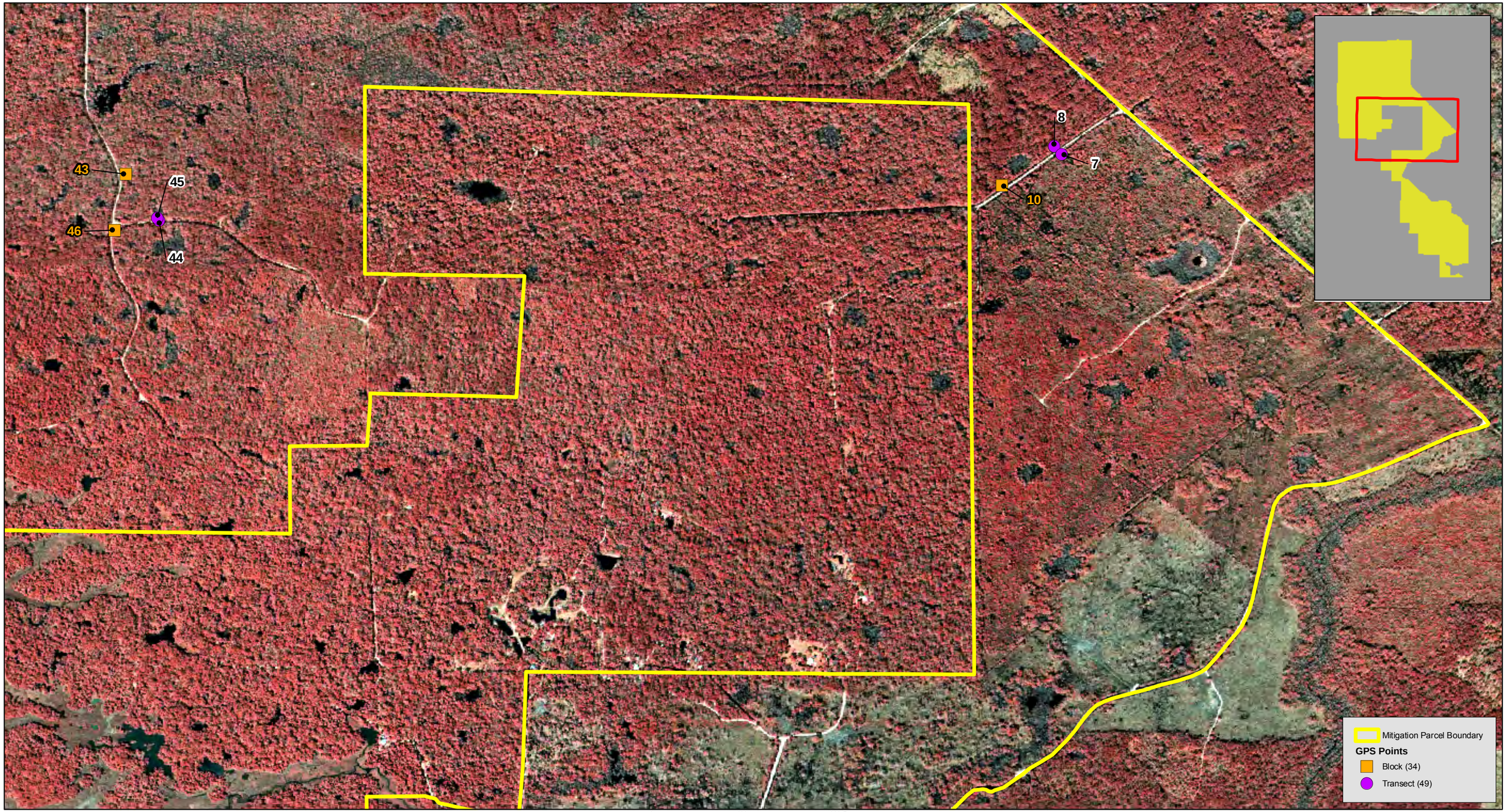

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Figure 9.
Hydrologic Improvement Evaluation Locations Map

Tarmac King Road Limestone Mine
Mitigation Parcel
Levy County, Florida

Image:2007IR

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Coordinate System:
NAD 1983 UTM Zone 10N feet

Date: 12/21/09 Rev. Date: 02/02/2010 PM: MEE GIS Analyst: GdA Map Document: hydro_improve_mit-central_GPS_B_gda_20100106.mxd Project Number: 7856-001 PDF Document: hydro_improve_mit-central_GPS_B_gda_20100202.pdf Plot Size: 11 x 17

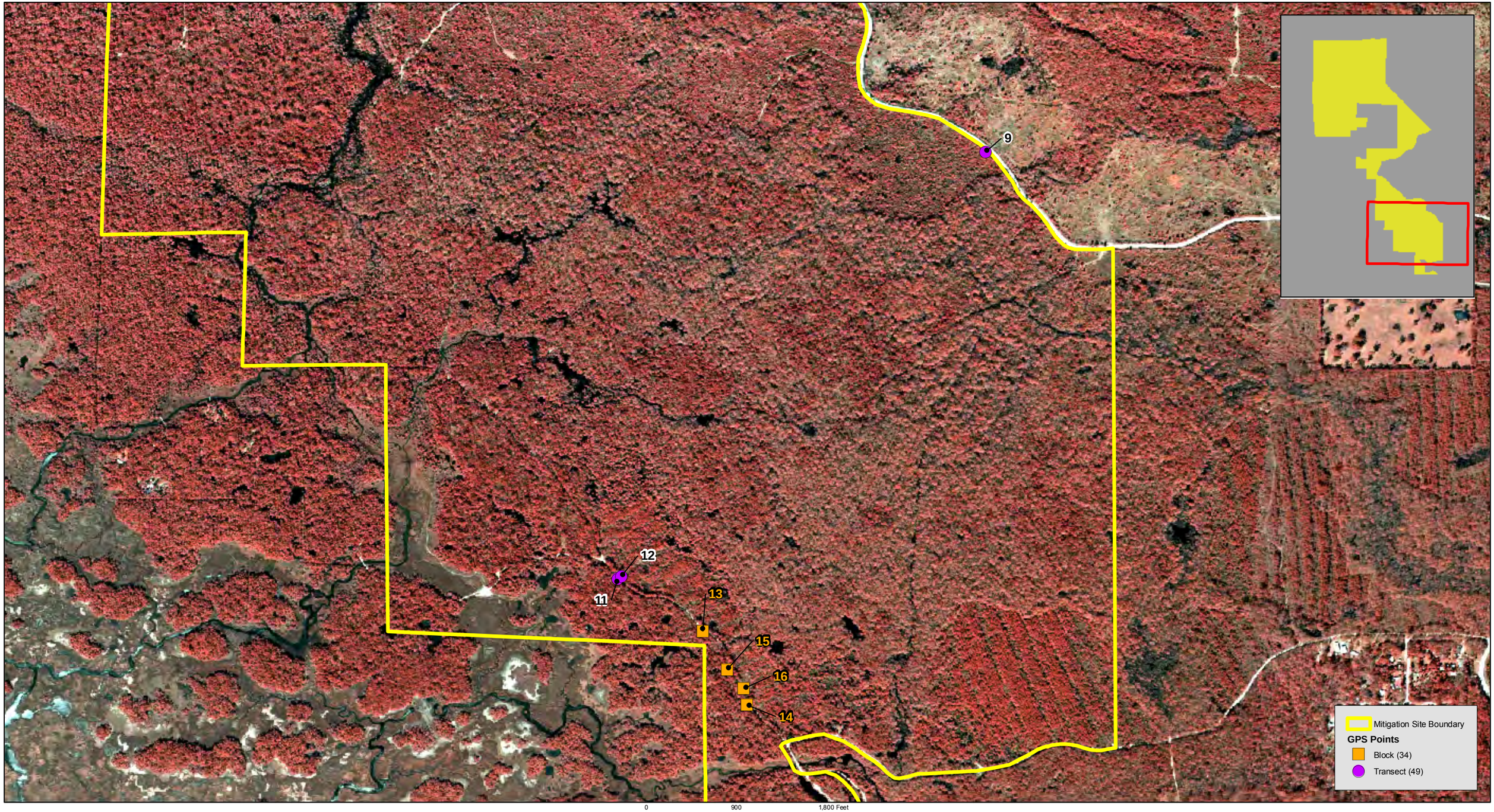

Figure 10.
Hydrologic Improvement Evaluation Locations Map

Tarmac King Road Limestone Mine
Mitigation Parcel
Levy County, Florida

Image:2007IR

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Coordinate System:
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Date: 12/21/09 Rev. Date: 02/02/2010 PM: MEE GIS Analyst: GdA Map Document: hydro_improve_mit-south_GPS_B_gda_20100106.mxd Project Number: 7856-001 PDF Document: hydro_improve_mit-south_GPS_B_gda_20100202.pdf Plot Size: 11 x 17

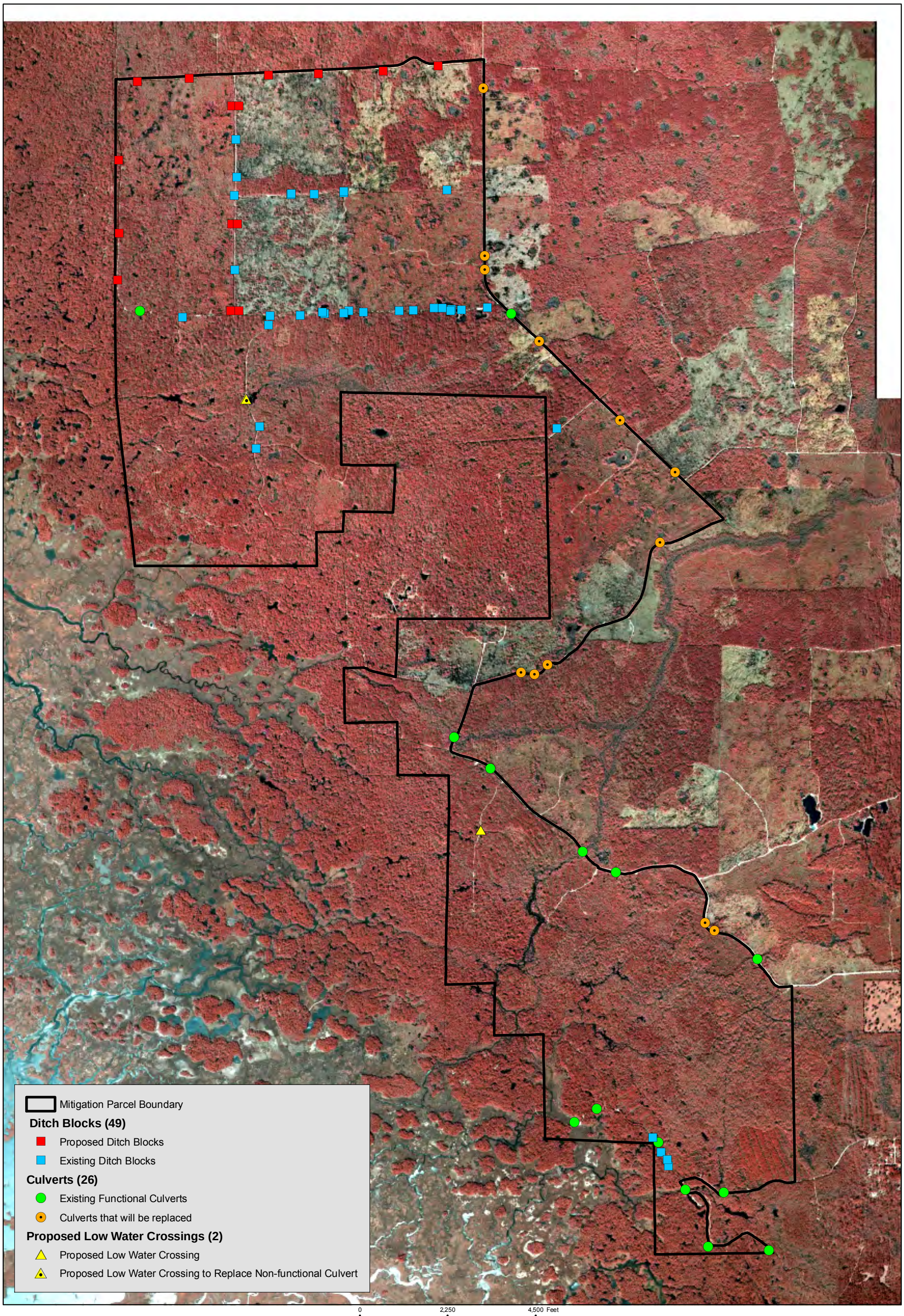

Figure 11.
Hydrologic Improvement Map

Tarmac King Road Limestone Mine
Mitigation Parcel
Levy County, Florida

Image: 2007 IR

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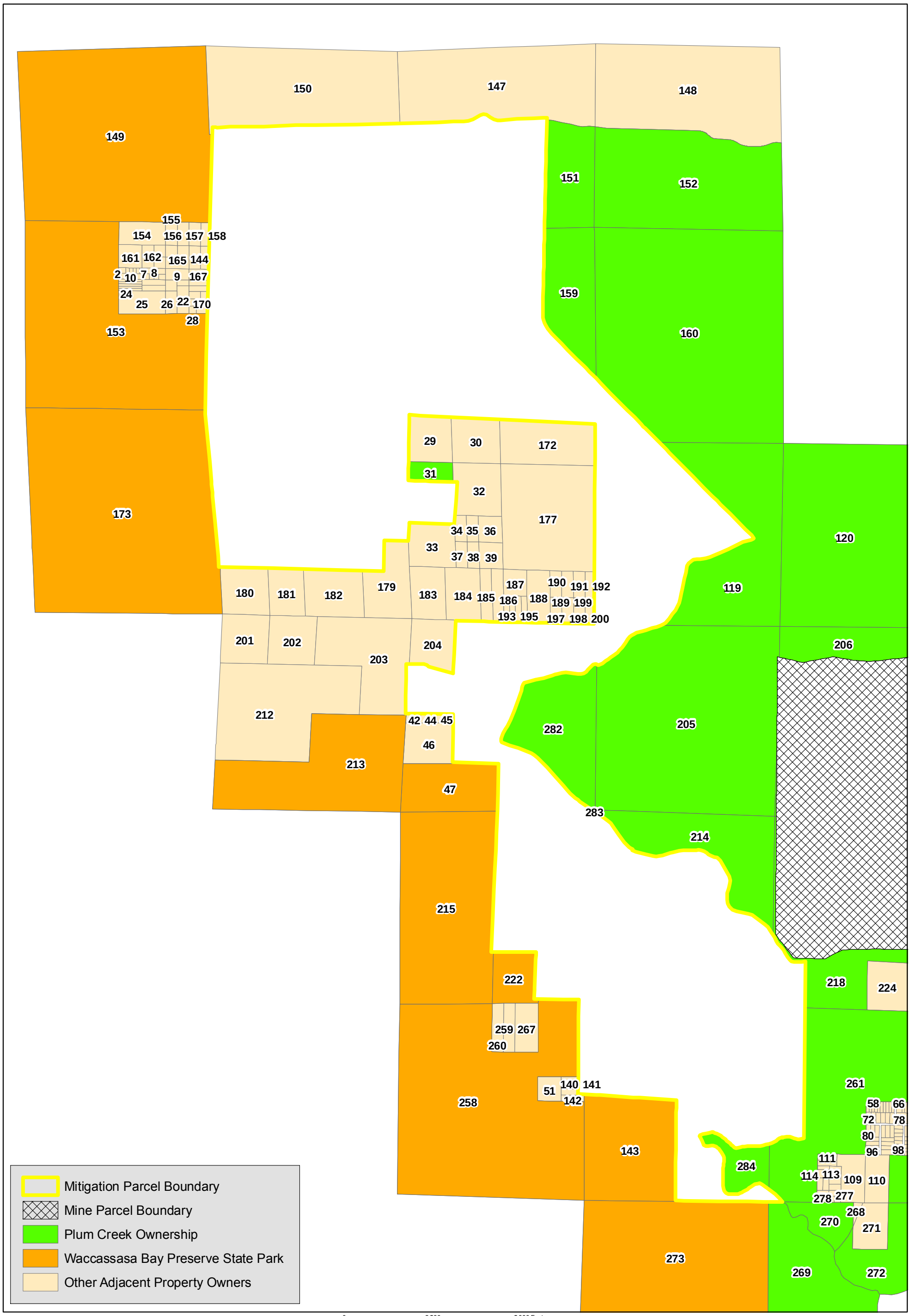

Adjacent Property Owners Map
Mitigation Parcel

Tarmac King Road Limestone Mine
Levy County, Florida

Image:None

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Coordinate System:
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Date: 02/01/2010 Rev. Date: 02/02/2010 PM: MEE GIS Analyst: GdA Map Document: APO_Plum_Creek_Mit_B_gda_20100201.mxd Project Number: 7856-001 PDF Document: APO_plum_creek_Mitigation_B_gda_20100201.pdf Plot Size: 11 x 17

For Appendix A, "Culvert Field Notes and Photographic Documentation", please refer to the Library at www.kingroadeis.com

For Appendix B, "Established Ditch Transect Field Notes and Photographic Documentation", please refer to the Library at www.kingroadeis.com

For Appendix C, "Existing Ditch Block Field Notes and Photographic Documentation", please refer to the Library at www.kingroadeis.com

ATTACHMENT H – TURBIDITY MANAGEMENT PLAN

Best management practices (BMPs) for the control of turbidity and erosion will be implemented during all work on site. All construction activities shall be conducted in accordance with state and federal National Pollutant Discharge Elimination System (NPDES) regulations as set forth in Section 403.0885, F.S., Chapter 62-621.300(4), F.A.C. and an approved Stormwater Pollution Prevention Plan (SWPPP). Graded areas will be stabilized within 48 hours of attaining final grades and at any other time necessary to prevent erosion, siltation and turbid discharges in violation of state water quality standards. Monitoring during construction activities is intended to ensure compliance with best management practices, to minimize wetland impacts and to ensure that there are no turbidity plumes or violations of state water quality standards. Whenever possible, construction and earthmoving activities will be conducted in dry conditions such that there are no turbid discharges into open water systems. If activities must be conducted in or near open water systems, turbidity and/or silt screens will be utilized in accordance with BMPs, and monitoring the open waters upstream (or out of the influence of the activity) will be conducted. If, at any time, turbidity at the downstream site is 29 NTU's or greater than at the upstream site, activities will be discontinued until the problem is rectified. The Florida Department of Environmental Protection will be informed within 24 hours of the event by phone, FAX or e-mail (with follow-up written memo) of the cause and remedies implemented will be indicated.

ATTACHMENT I – QUALIFIED MITIGATION SUPERVISOR

Prior to commencement of any construction activities, the permittee shall retain a Qualified Mitigation Supervisor (QMS) (a person or persons) to oversee all aspects of mitigation site implementation, management, monitoring, and corrective actions until final success criteria are met.

a. Although the permittee will have the ultimate responsibility, the QMS shall have the duty to ensure that the mitigation work and reporting is conducted in accordance with the permit.

b. Within 30 days of permit issuance, the permittee shall submit the name of the QMS retained to oversee the mitigation work and provide supporting documentation demonstrating that the QMS is authorized and qualified to oversee this work. The permittee will not commence work on the mitigation site until approval of the selected QMS is received from the Department.

c. Within 30 days of the discharge of any approved QMS, the permittee shall submit the name and supporting documentation of a new QMS to the Department for review.

d. The permittee will have the approved qualified QMS review the conditions of the permit that pertain to environmental enhancements. The purpose of this review is to ascertain whether any criteria need to be modified to ensure ecological success. If the Department concurs that any proposed modifications would improve the likelihood of mitigation success, the permittee will submit the modification request to the Department for processing.

ATTACHMENT J – FIRE MANAGEMENT PLAN

The overall goals for prescribed burns are to mimic natural fire regimes and restore a more natural and historical ecological condition on site. As the vast majority of the mitigation site is not a fire dependent community, primarily as a result of site hydrology, controlled burns are only proposed as a method to dispose of accumulated debris as a result of previously or future site harvesting activities or the disposal of cleared undesirable vegetation. Because of the number of variables to be considered prior to burning debris piles, weather conditions, fuel, safety and goals, timing and sequencing is dependent on vigilant awareness and forecasting a Qualified Mitigation Supervisor (QMS) and fire team. Selective burning of debris piles and mechanical treatment may be used in areas that might need supplemental treatments throughout all years of site management.

All personnel present at the debris pile burning events will carry Personal Protective Equipment (PPE). All radio communications will utilize plain language.

ATTACHMENT K - SECURITY, HUNTING, AND RECREATION PLAN

I. Security

A. **Gates:** All entrance roads will be gated to control access and will be constructed of 4-inch steel channel, painted blaze orange, and equipped with reflective tape, and signage. Security housing around locks will be used to reduce the threat of illegal entry into the area. Gates will be monitored at least twice per month for signs of trespass and/or security breaches. Security gate damage will be repaired immediately.

B. **Signs:** The area boundary will be posted at 1,000 foot intervals, at access gates and along roads. The permittee will be responsible for replacement of damaged security signs.

II. Hunting

It is the intent of the permittee to allow the Tarmac Mitigation Site to remain a vital part of the Gulf Hammock Wildlife Management Area (GHWMA), and that hunting and similar recreational activities continue to be managed by the Florida Fish and Wildlife Conservation Commission (FWC). Accordingly, within XXX days of issuance of the ERP, the permittee will submit a hunting and recreational activity lease agreement to the FDEP for their review and approval. Such lease shall be consistent with the conservation easement, the approved form of which is attached hereto and incorporated by reference. Permanent hunt stands or equipment, food plots and baiting will be prohibited.

A. Hunting Leases

If at any point the mitigation property is no longer leased to the FWC, either as a result of legislation and/or either party, any ensuing lease must be approved by FDEP, subject to the goals and conditions of the conservation easement.

III. Recreational Activities

Recreation is limited to the following activities: Hiking, horseback riding on remaining monitoring roads only, bird and wildlife observation, non-professional beekeeping, sustainable seed collection for restoration, and educational field trips or research. All educational field trips shall be guided by the Qualified Mitigation Supervisor (QMS), the permittee, or the FWC. Attendees must follow the restrictions specified below. If at any time the QMS determines that any hunting or recreational activity would restrict ecological management or progress toward success criteria, such activities shall be discontinued and reported to the Department along with a plan for correction of the problem and/or modification of the permit.

IV. Restrictions and Notifications

A. Restrictions

1. No modification or disturbance of habitats is allowed.
2. All vehicle use will be restricted to existing roads only. The only allowable uses for vehicles are hunting and recreation specified herein, monitoring, restoration activities, and security.

3. Equestrian activities will be limited to remaining roads that are not proposed for restoration. Five horses will be allowed on site at a time. Loading and unloading areas will be limited to remaining roads. All equipment and trash will be removed from the site after the activity is complete.
4. Other than the game species allowed for hunting, no plants or animals may be removed. Destruction, harassment or taking of any Threatened and Endangered Species protected under Endangered Species Act, Chapter 5B-40, F.A.C., or Rule 68A-27, F.A.C., is prohibited.

B. Notification

1. All unauthorized persons, signs of trespassing, signs of illegal activities or disturbances, and violations of hunting terms will be reported to the permittee and QMS within 24 hours of discovery. A remedial plan will be developed by the permittee or QMS within 30 days and submitted to the Department.
2. The permittee and FWC will maintain a list of people or groups visiting the site for hunting, recreation and educational purposes. This list will be available for review at the request of the FWC and the Department.

ATTACHMENT L – MITIGATION COST ESTIMATE

1.0 Restoration to Natural Plant Communities – Year 1

Reversing the Effects of Silviculture

In the first year of the mitigation effort, all further silvicultural activities not directly related to restoration will cease and planted pines will be thinned in accordance with the Tarmac King Road Limestone Mine Compensatory Mitigation Plan.

Restoring Natural Hydrology

All hydrologic enhancements proposed in Attachment G will be conducted in the first year.

Selective Burning

If warranted, localized burning will occur in accordance with Attachment J.

Supplemental Planting

As determined by quantitative and qualitative monitoring results (Attachment C), supplemental planting of the species listed in Attachment D (Table D-1) in areas with less than 300 tree stems per acre or less than 200 shrub stems per acre to meet these minimum requirements. Supplemental planting also will occur if less than 80% of the species in the target community type (Table D-1) are detected with a focus on those species that are most under represented by monitoring. These focal species will be planted in loose groupings of 10-12 individual plants to ensure that all planted obligate out crossing species will be pollinated. The goal of this latter effort is to inoculate the community type with a broad spectrum of representative species that can successfully reproduce and colonize the remainder of the plant community in the future.

2.0 Nuisance and Exotic Plant Species Treatments

ENTRIX will control nuisance and exotic plant species in accordance with Attachment E of the Tarmac King Road Limestone Mine Compensatory Mitigation Plan. Target species will be those listed as invasive by the Florida Exotic Pest Plant Council including cogongrass (*Imperata cylindrica*), air potato (*Dioscorea bulbifera*), and Japanese honeysuckle (*Lonicera japonica*).

All treatments will be performed by State certified applicators using Environmental Protection Agency approved herbicides. All treated vegetation will be left in place to decompose naturally. The initial treatment will take place prior to any other work on the mitigation sites to prevent the inadvertent spread of nuisance and exotic plants. In Years 1-3, treatments will be conducted monthly for a three-year total of 36 events. In Years 4 and 5 treatments will be conducted quarterly for a two-year total of eight events.

3.0 Monitoring

Monitoring will be conducted in accordance with the Tarmac King Road Limestone Mine Compensatory

Mitigation Plan (Attachment C).

Monitoring of mitigation efforts is proposed to document the effectiveness of the restoration/enhancement activities, identify and recommend any needed remedial actions, and to measure the progression of the restored/enhanced areas toward meeting the success criteria established for each plant community type (Attachment F) as part of the mitigation plan.

Both qualitative and quantitative monitoring is proposed to occur annually in the late summer/fall for each plant community to be restored or enhanced. Qualitative monitoring provides for documentation of general conditions and provision of needed management recommendations across a large area. Quantitative monitoring provides reproducible sampling of species composition and diversity to track progress of restoration over time. Photographs provide a visual means to track progression over time and to document unique features/circumstances that may not otherwise be captured.

a. Quantitative Monitoring

Quantitative monitoring is provided to document the progress of the restoration/enhancement areas in a manner that is objective, trackable over time, and independent of observer biases. A series of transects will be established in each target plant community. Each transect will be located at a representative site in a major restoration/enhancement area and will be wholly contained within that area. The specific location of each transect locations will be randomized to the greatest extent practicable, via selection of a starting point and a random compass direction within the community with the direction constrained such that the transect remains within the community.

A minimum of 24 quantitative transects will be established throughout the restoration/enhancement areas. The beginning and end points of each transect will be permanently marked and these coordinates recorded by a GPS. Transects will be distributed according to the post restoration/enhancement target communities as indicated below:

Mesic Hammock (421 acres) = 4 transects
Coastal Mesic Hammock (36 acres) = 2 transects
Hydric Hammock (1,865 acres) = 18 transects
Note: all coastal hydric hammock areas are in preservation areas and not in need of restoration/enhancement, hence none need to be sampled

Canopy/Subcanopy Sampling

In natural forests, canopy trees are typically fairly widely spaced and the most efficient means to get species richness and relative dominance are various forms of plotless sampling. In this monitoring protocol, canopy trees will be defined as all species 4 inches (10.2 cm) or more in diameter at "breast height" (DBH - 4.5 feet above the ground). Subcanopy trees will be defined as all species 1 inch (2.5 cm) or more in DBH. Shrubs are defined as those woody plants smaller than sub-canopy/understory trees and greater than 3 feet (1 meter) in height.

Sampling will occur at 50-foot intervals along the transects following the Point- Centered-Quarter methodology. The 50-foot interval may be adjusted upward (by 25 foot) if the resulting selection of species at any interval results in the recounting of individual trees/shrubs. The specific intervals will be determined during the first sampling event and marked (with PVC poles or other

suitable alternative). Each transect will have 25 sample points. At each sample point, the closest canopy two trees in each quadrant determined by the transect line and a line perpendicular to it, will be identified. Likewise, the closest two subcanopy trees, and closest two shrub stems, in each quadrant will be identified. The distance to the closest tree/subcanopy tree/shrub will be measured. For all, the species will be recorded. Individual trees will be marked so that distances will not need to be measured unless an individual moves from one size class to another or dies, resulting in a need to re-tally the individuals in the quadrant.

In addition to the above, above-surface water depth, occurrence of nuisance species, and occurrence of listed species will be recorded if they occur within a 2-m radius of each point.

The following data will be reported based on transect sampling:

Species richness;
Canopy and subcanopy shrub composition based on relative numbers of individuals encountered along the transect; and
Density by species;
Water depths along the transect.

Quantitative monitoring will be initiated prior to management activities to document the baseline condition. Additional monitoring will not occur until the management activities have been initiated including any needed thinning of pines and initial supplemental planting. Once initiated, quantitative monitoring will be conducted in September-October in alternate years.

b. Qualitative Monitoring

The goal of qualitative vegetation monitoring is to provide information useful to management and over a broad area to document success of the restoration and management activities. Areas undergoing active restoration (thinning and initial planting) will be limited to qualitative assessment until the active restoration activities are complete.

A minimum of 24 qualitative transects will be established throughout the restoration/enhancement areas. Transects will be randomly located each monitoring event and will not overlap the quantitative transects to increase coverage and habitat representation. Transects will be distributed according to the post restoration/enhancement target communities as indicated below:

Mesic Hammock (421 acres) = 4 transects
Coastal Mesic Hammock (36 acres) = 2 transects
Hydric Hammock (1,865 acres) = 18 transects
Note: all coastal hydric hammock areas are in preservation areas and not in need of restoration/enhancement, hence none need to be sampled

Qualitative monitoring will be based on 20-minute wandering “transects” covering an area of 20 acres each conducted annually. Each transect will provide photo-documentation and comments on vegetation composition, cover, dominance, recruitment of new species, reproductive status, groundcover composition, hydrologic condition, observations of rare (listed) species, and nuisance species occurrence based on the wandering transect. A GPS track log will be recorded for each qualitative transects. GPS locations will be established for any location needing specific

management including but not limited to observations of breeding locations for federal or Florida-listed endangered or threatened wildlife, occurrence of nuisance species, and recommendations for site-specific management. Photo-documentation will be provided to document any rare species, or areas of unusual conditions that might affect future management (blow-downs from severe storms, fire, etc.). Associated GPS points will be provided for photographs.

The following data will be reported based on qualitative sampling:

Species richness of trees, subcanopy trees, and shrubs;
Rare species occurrences (with GPS points)
Management recommendations (such as pine removal, vine control, etc.)
Nuisance species control recommendations
Notes on disturbances which could affect management needs.
Notes on groundcover composition

c. Photographic Documentation

Vegetative conditions at the quantitatively monitored transects and at representative locations will be documented with photographs. Permanent photo-stations will be established and marked with PVC, rebar, or other appropriate materials. Two photo-stations will be established at strategic locations along each transect, usually at the start and end. An additional ten permanent photo stations will be established at representative spot locations throughout the restoration areas.

At each photo-station, representative and specific field of view photographs will be taken in such a way that they can be replicated during each monitoring event. These photographs will document cover and growth of the restoration areas through comparison of photographs taken from these specific photo stations. Photographs will be taken from a tripod set up to the same specifications each time (height and location) using a cameras set to have the same field of view. The location of transects and photo stations will be shown on the monitoring base map. GPS coordinates will be collected and provided for each photo-station.

d. Reporting

Reporting of qualitative, quantitative and photographic monitoring events will be summarized and submitted annually, no later than December 31 of each year. Monitoring data will be summarized in a tabular-style report for ease of review and comparisons from year to year.

The following data will be summarized, by restoration/enhancement area, in the annual monitoring report:

1. Species richness;
2. Relative dominance/abundance of canopy, subcanopy and shrub species;
3. Density of pines, by species;
4. Simpson's index of diversity (for canopy and subcanopy transect data combined)
5. Water depths along the transects;
6. Observations of wildlife utilization;
7. List of any rare species observed;
8. Photographic documentation;

9. Discussion of nuisance or non-native plant species occurrence and density (with map, as needed);
10. Description of management activities completed since the previous reporting;
11. Overall ecological evaluation of target plant communities; and
12. Recommended remedial actions, if needed.

4.0 Cost

The compensation for services of principals and employees of ENTRIX rendered pursuant to the Scope of Services of this agreement is as follows:

Task 1.0		
	Selective Pine Harvest and Debris Removal	$ 1,580,480.00
	Hydrologic Enhancement	$ 95,750.00
	Selective Burning	$ 51,950.00
	Supplemental Planting	$ 48,200.00
Task 2.0	Nuisance Plant Treatments	
	Initial Event	$ 75,000.00
	Years 1-3 (36 events @ $14,550.00/event)	$ 523,800.00
	Years 4-5 (8 events @ $10,000.00/event)	$ 80,000.00
Task 3.0	Monitoring	
	Set-up Event	$ 55,950.00
	Years 2-4 (4 events @ $51,450.00 event)	$ 205,800.00
Years 1 – 5 Total		$ 2,716,930.00

For Task 1.0 invoices will be submitted on a percent completion basis of a specific restoration area. For Tasks 2.0 and 3.0 invoices will be submitted on completion of each task or event.

All rates and fees shall be subject to renegotiation after a one (1) month period from the date of this Agreement if it has not been accepted. In the event new or additional regulations are adopted or implemented after the date of this Agreement, any additional work effort will be extra to this Agreement.

5.0 Mitigation Compliance

Please note that these costs do not include extensive coordination or negotiation with regulatory agencies (e.g., unscheduled field or office meetings) regarding permit compliance deficiencies outside the control of ENTRIX.

6.0 Proposal Assumptions

General

- The Client will make provision for ENTRIX to enter upon public and private property as required to perform services under this agreement.

- This Scope of Services does not include permit modifications, including negotiations with regulatory agencies or necessary corrective actions.
- Any work or items not specifically included are excluded.
- These notes become part of any contract or agreement entered into, unless specific exceptions are made in writing stating otherwise, adding to or deleting from the scope of work.

Selective Clearing

- Costs do not include the sale of merchantable timber.

Hydrologic Enhancements

- Ditch blocks will require a soil plug that is approximately 15-ft. wide, 20-ft. long and 3-ft. in depth.
- Low water crossings will be Geoweb fabric backfilled with appropriate gravel and will be approximately 25-ft. wide and 50-ft. long.
- Structures will be replaced with new structures of similar type and material as those currently in place.

Supplemental Planting

- The planting areas will be readily accessible to vehicular traffic during the initial planting activities. Should vehicular access be restricted, the additional time required to deliver the plant material to the planting area will be billed as additional services.
- All plants, trees, sod, etc. required for this job are subject to market availability.
- Clean up of site is limited to debris and waste generated by our operations.
- Costs assume the need to plant 1% of mitigation activity types W1, W2, U1 and U2, 20% of mitigation activity type W4, 5% of mitigation activity type U3, and that no supplemental planting will be needed in mitigation activity type W3.

Monitoring

- These costs assume that the monitoring methods, as briefly outlined in this scope, are accepted by the agencies. The methods, as outlined, are designed for the qualitative collection of monitoring data on which to base subsequent monitoring reports. If more quantitative sampling methods are required by the regulating agencies, this contract will need to be amended to allow for new methods approval and implementation.

Maintenance

- The proposed maintenance schedule and cost estimate are based on existing conditions of the project area at the time of this proposal. Certain situations such as the introduction of seeds or propagules of exotic plants by the movement of contaminated machinery may increase the cover by nuisance species and therefore the cost of maintenance. ENTRIX will contact the client immediately if any conditions are noted on the site that will make more frequent maintenance necessary and provide an estimate of remedial measures.
- Costs for maintenance assume that there will be water (well) available to use for mixing herbicides.
- Costs for maintenance also assume that all equipment will be free of exotic plant parts prior to entering the site.

APPENDIX H
SOIL DRAINAGE CLASS MAPS FOR AVON PARK FORMATION OUTCROPPINGS IN LEVY COUNTY

APPENDIX H
SOIL DRAINAGE CLASS MAPS FOR AVON PARK FORMATION OUTCROPPINGS IN LEVY COUNTY

H.1 INTRODUCTION

The three maps included in this appendix identify the soil drainage classes for the three Avon Park Formation outcroppings in Levy County, Florida. As discussed in Chapter 2, Section 2.2.1.2, these maps are from the Natural Resources Conservation Service Web Soil Survey (NRCS 2012). The U.S. Army Corps of Engineers used these maps in conjunction with National Wetlands Inventory data and prior fieldwork to approximate wetlands coverage in these areas.

H.2 REFERENCES

NRCS (National Resources Conservation Service), 2012, Soil Drainage Classes for Avon Park Formation Outcroppings in Levy County, Florida, accessed through http://websoilsurvey.nrcs.usda.gov?, March 30.

Figure H–1. Soil Drainage Classes in Southernmost Avon Formation Outcropping in Levy County

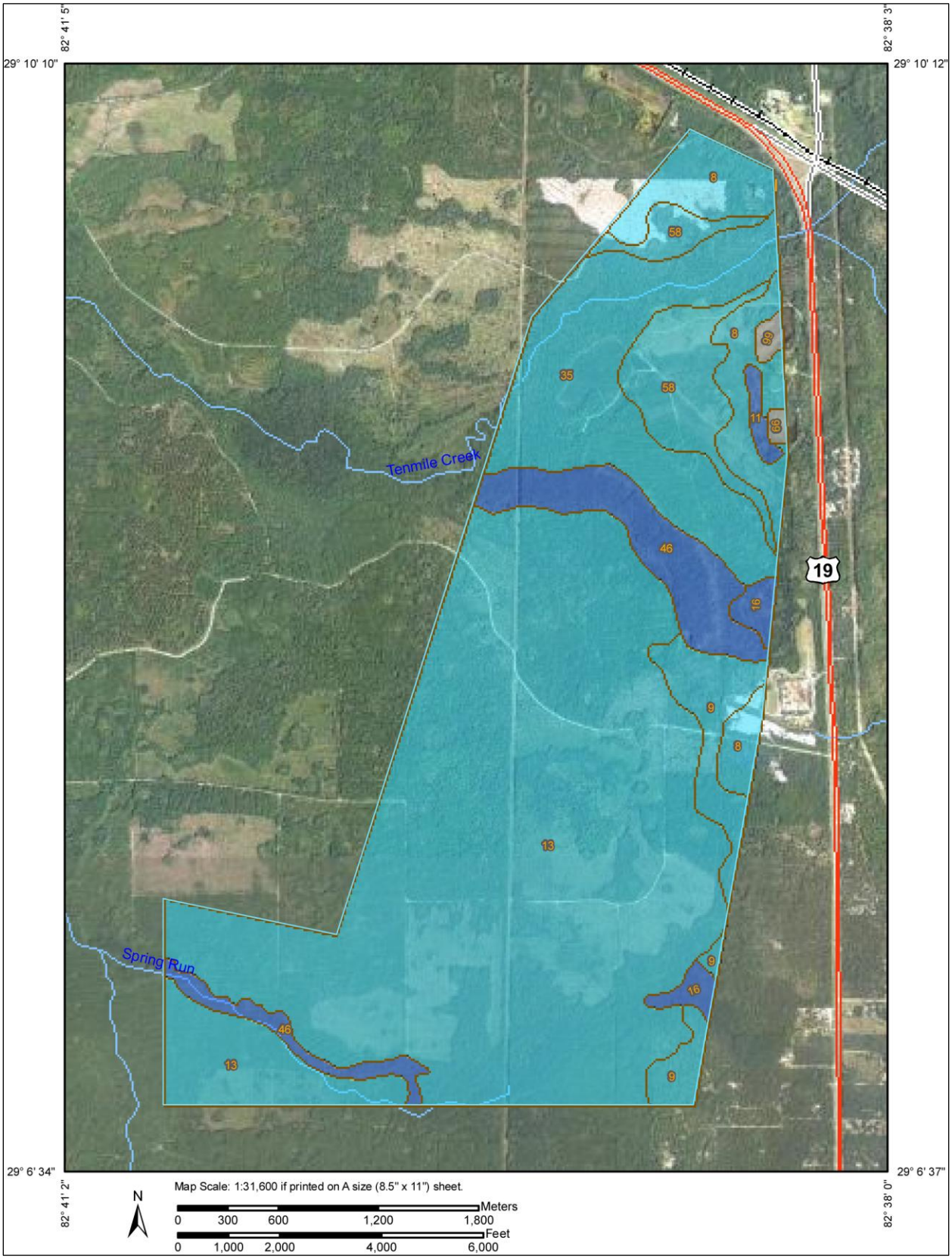

Figure H–1. Soil Drainage Classes in Southernmost Avon Formation Outcropping in Levy County

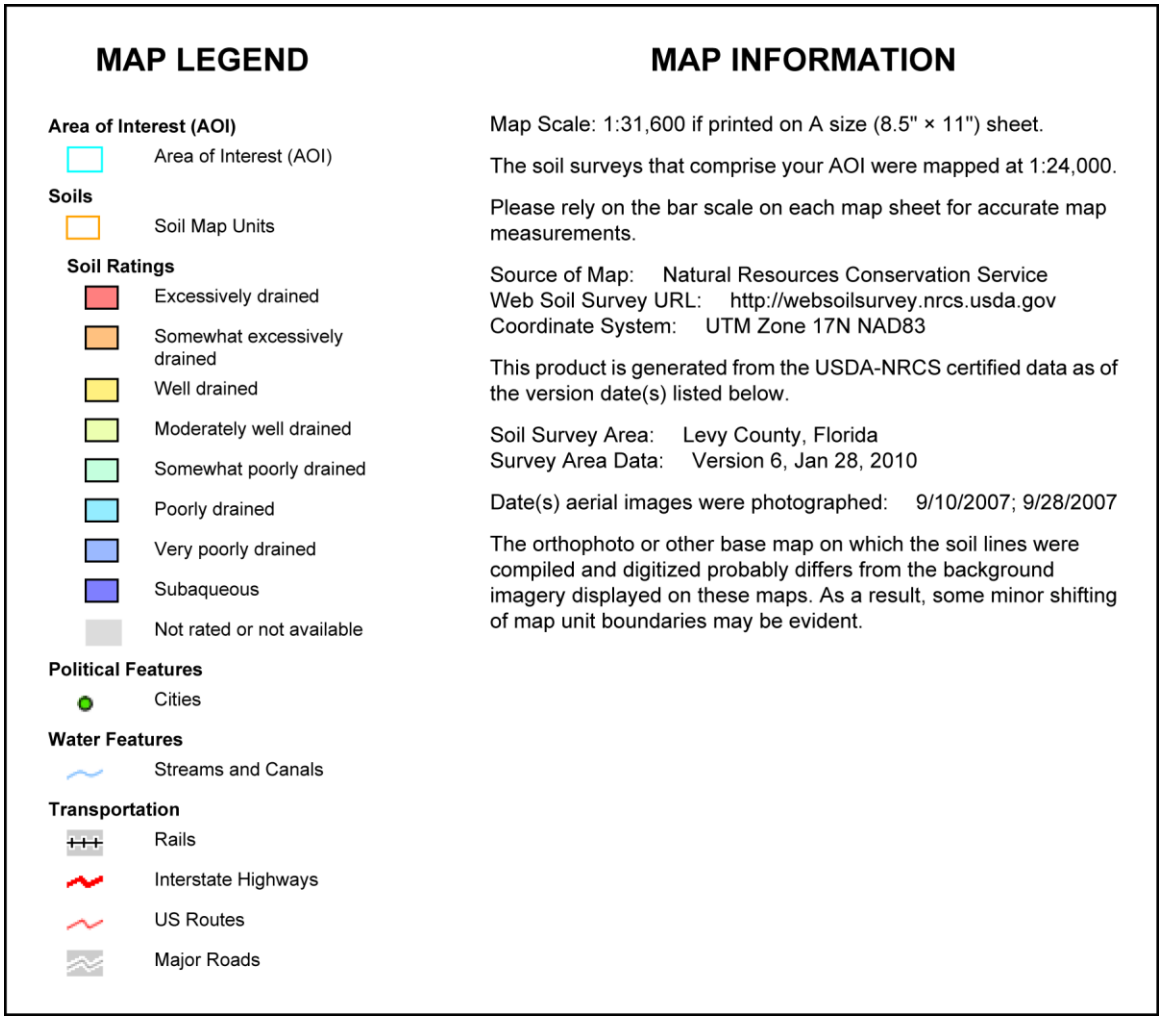

Figure H–1. Soil Drainage Classes in Southernmost Avon Formation Outcropping in Levy County (*continued*)

Drainage Class

Drainage Class— Summary by Map Unit — Levy County, Florida (FL075)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Smyrna fine sand	Poorly drained	193.1	6.6%
9	Pomona fine sand	Poorly drained	123.6	4.2%
11	Placid and Samsula soils, depressional	Very poorly drained	13.6	0.5%
13	Wekiva fine sand	Poorly drained	1,810.4	62.1%
16	Chobee-Gator complex, frequently flooded	Very poorly drained	34.3	1.2%
35	Pineda fine sand, limestone substratum	Poorly drained	380.3	13.0%
46	Chobee muck, limestone substratum, frequently flooded	Very poorly drained	188.6	6.5%
58	Boca-Holopaw,limestone substratum, complex	Poorly drained	158.6	5.4%
99	Water		14.8	0.5%
Totals for Area of Interest			**2,917.3**	**100.0%**

Description

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized-excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Figure H–1. Soil Drainage Classes in Southernmost Avon Formation Outcropping in Levy County (*continued*)

Figure H–2. Soil Drainage Classes in Central Avon Park Formation Outcropping in Levy County

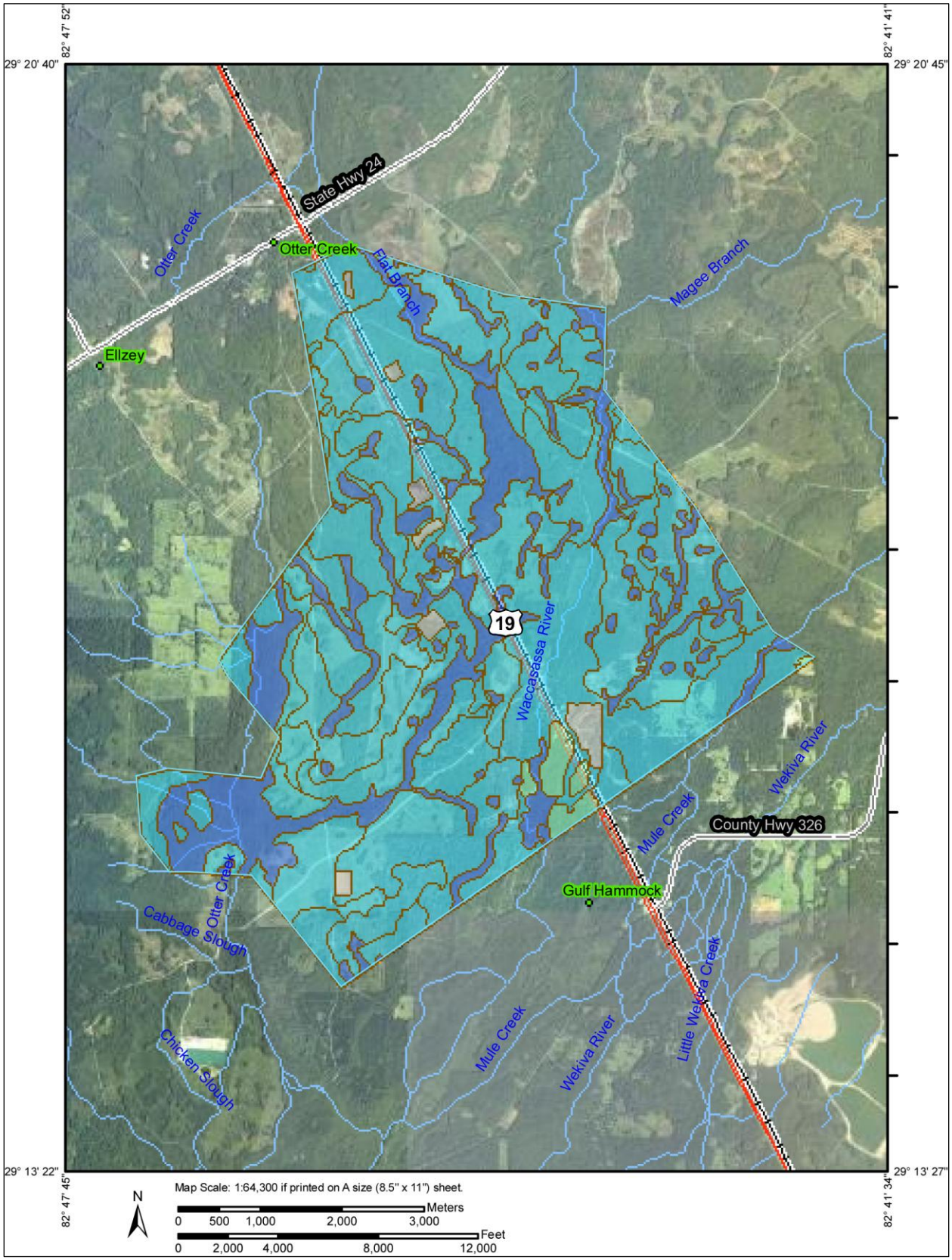

Figure H–2. Soil Drainage Classes in Central Avon Park Formation Outcropping in Levy County

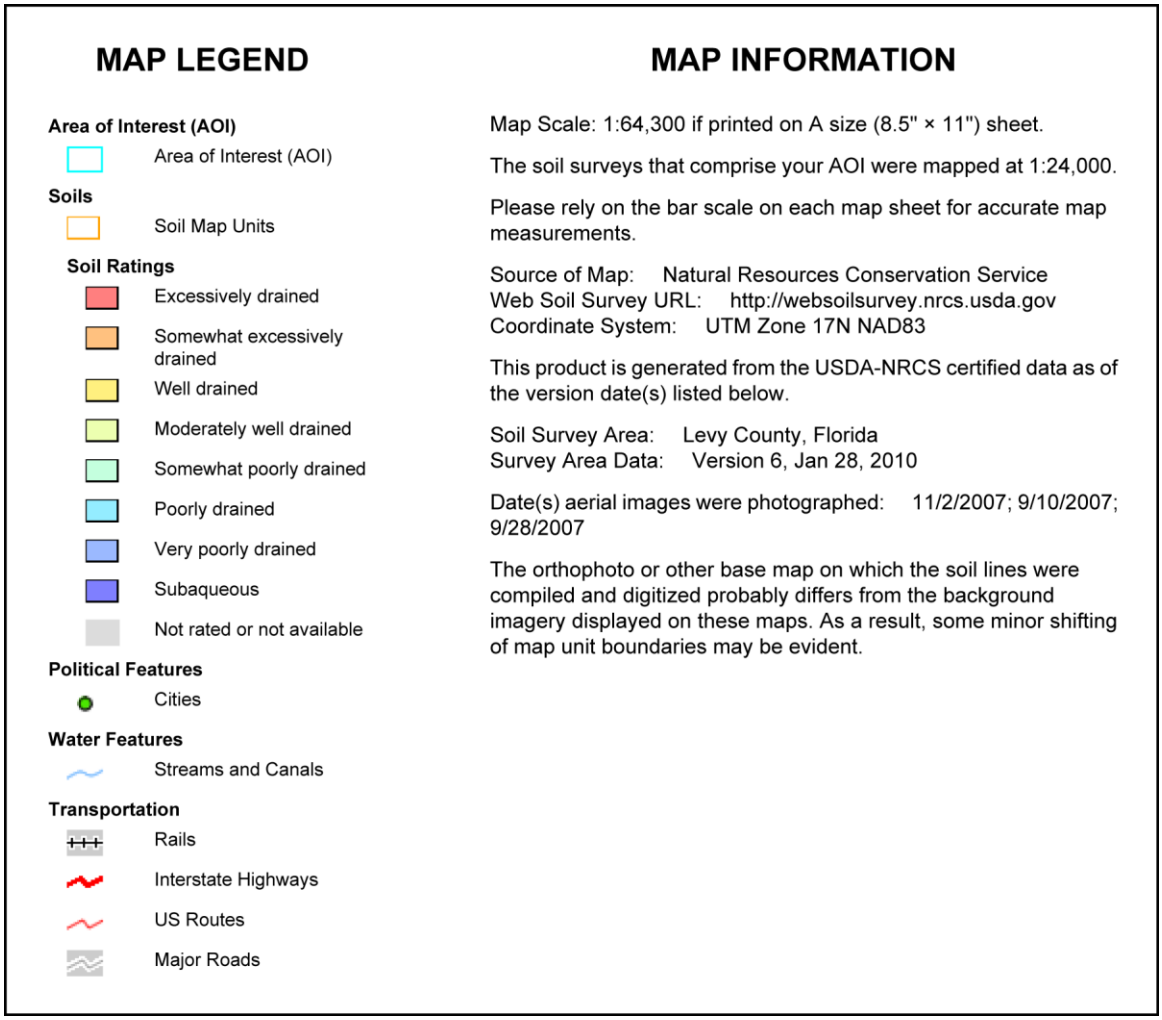

Figure H–2. Soil Drainage Classes in Central Avon Park Formation Outcropping in Levy County (*continued*)

Drainage Class

Drainage Class— Summary by Map Unit — Levy County, Florida (FL075)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
5	Immokalee fine sand	Poorly drained	543.1	5.8%
8	Smyrna fine sand	Poorly drained	892.2	9.5%
9	Pomona fine sand	Poorly drained	581.0	6.2%
11	Placid and Samsula soils, depressional	Very poorly drained	30.4	0.3%
13	Wekiva fine sand	Poorly drained	1,506.8	16.1%
18	Wauchula fine sand	Poorly drained	913.3	9.7%
21	Pompano fine sand	Poorly drained	92.4	1.0%
25	Pits and Dumps		73.7	0.8%
27	Placid and Popash soils, depressional	Very poorly drained	86.3	0.9%
29	Chobee-Bradenton complex, frequently flooded	Very poorly drained	474.3	5.1%
35	Pineda fine sand, limestone substratum	Poorly drained	58.0	0.6%
38	Myakka sand	Poorly drained	336.8	3.6%
39	Waccasassa-Demory complex, flooded	Poorly drained	243.2	2.6%
40	Pineda fine sand	Poorly drained	920.9	9.8%
46	Chobee muck, limestone substratum, frequently flooded	Very poorly drained	1,210.1	12.9%
50	Hicoria fine sandy loam, depressional	Very poorly drained	172.7	1.8%
58	Boca-Holopaw,limestone substratum, complex	Poorly drained	714.3	7.6%
59	Aripeka-Matmon complex	Somewhat poorly drained	144.5	1.5%
60	EauGallie-Holopaw complex, limestone substratum	Poorly drained	314.7	3.4%
99	Water		64.7	0.7%
Totals for Area of Interest			**9,372.6**	**100.0%**

Description

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized-excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Figure H–2. Soil Drainage Classes in Central Avon Park Formation Outcropping in Levy County (*continued*)

Figure H–3. Soil Drainage Classes in Westernmost Avon Park Formation Outcropping in Levy County

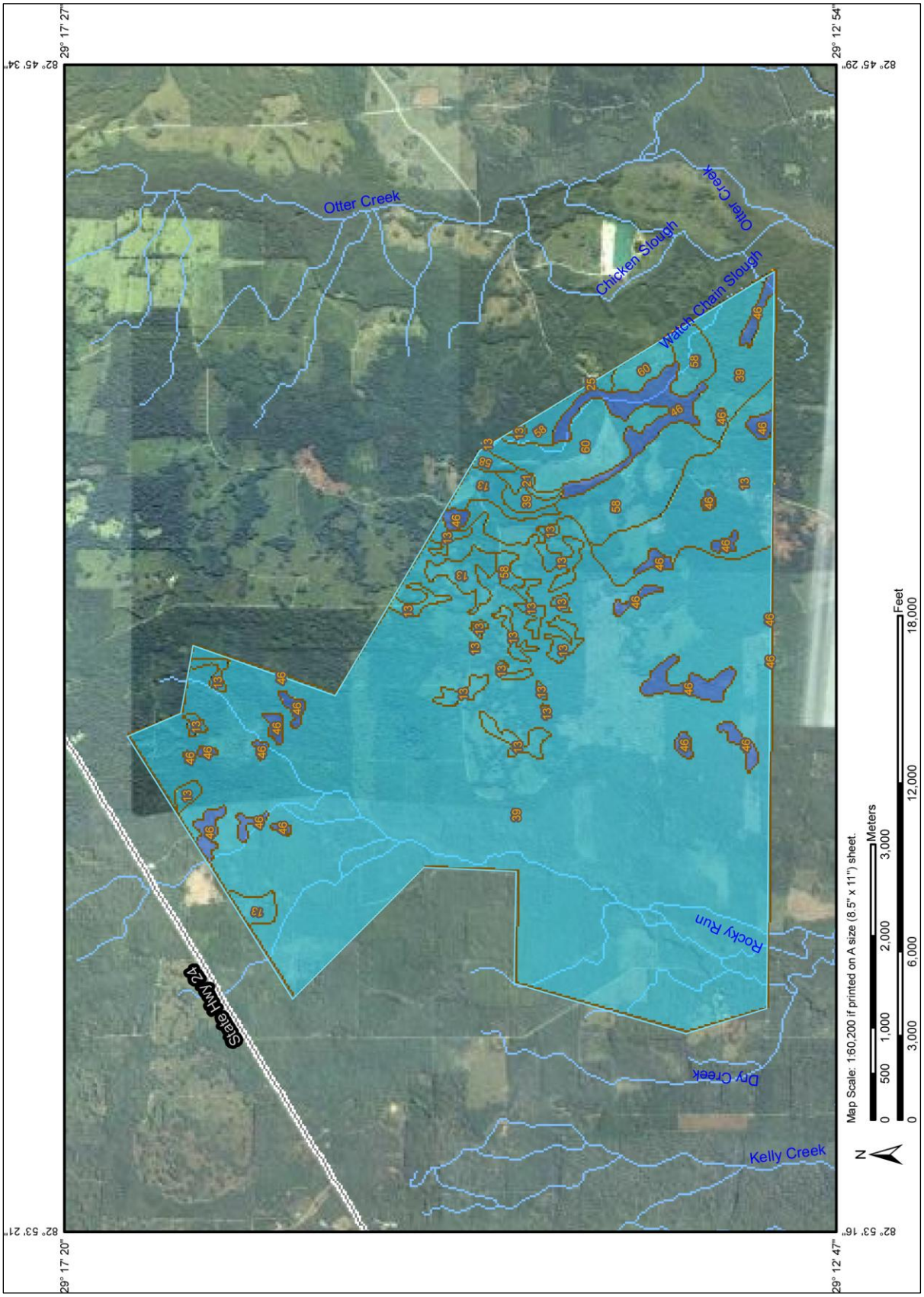

Figure H–3. Soil Drainage Classes in Westernmost Avon Park Formation Outcropping in Levy County

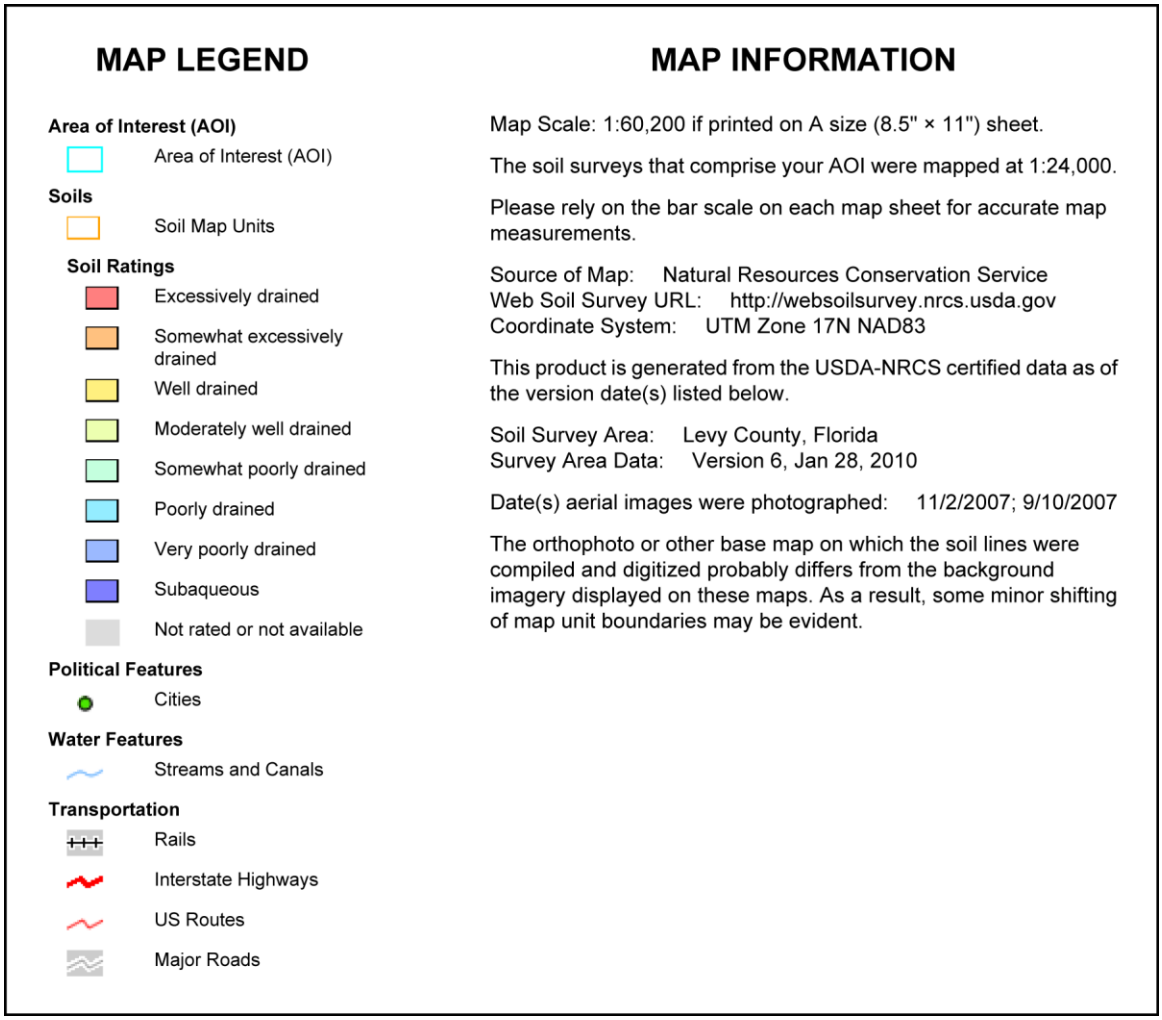

Figure H–3. Soil Drainage Classes in Westernmost Avon Park Formation Outcropping in Levy County (*continued*)

Drainage Class

Drainage Class— Summary by Map Unit — Levy County, Florida (FL075)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
13	Wekiva fine sand	Poorly drained	842.9	10.5%
21	Pompano fine sand	Poorly drained	21.9	0.3%
25	Pits and Dumps		0.0	0.0%
39	Waccasassa-Demory complex, flooded	Poorly drained	6,012.2	75.1%
46	Chobee muck, limestone substratum, frequently flooded	Very poorly drained	408.6	5.1%
58	Boca-Holopaw,limestone substratum, complex	Poorly drained	457.8	5.7%
60	EauGallie-Holopaw complex, limestone substratum	Poorly drained	258.4	3.2%
Totals for Area of Interest			**8,001.1**	**100.0%**

Description

"Drainage class (natural)" refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized-excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Figure H–3. Soil Drainage Classes in Westernmost Avon Park Formation Outcropping in Levy County (*continued*)

U.S. Army Corps of Engineers
Jacksonville District
August 2013